Public Health Aspects of Periodontal Diseases

CDC's Initiative to Develop Non-clinical Methods for Periodontal Disease Surveillance

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Overview

- Current status of periodontal disease surveillance

- Surveillance of health using self-report

- Developing self-report methodology for periodontal disease surveillance

CDC's Role in Oral Health

- **Primary responsibility is to support state- and community-based programs to prevent oral disease, promote oral health nationwide, and foster applied research to enhance oral disease prevention in community settings.**
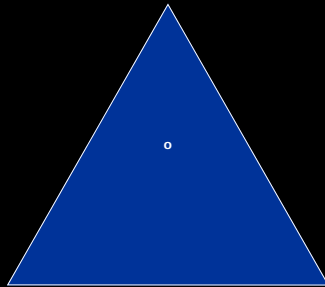
SURVEILLANCE

# Surveillance of Periodontal Disease at State and Local Levels

- **Current Status – No state/local level surveillance of periodontal disease**

- **Why ?**
  - **No surveillance systems that includes periodontal disease**
  - **Requirement of resource intensive clinical measures for identifying cases of periodontal disease**
  - **Variations in measures of periodontal diseases from state to state**

Why Monitor Periodontal Disease at State and Local Levels?

- **Increasingly older population**
- **Adults are retaining more of their teeth**
- **Prevalence may vary widely between/within states**
- **Disparities in SE determinants of disease**
- **Associations between periodontal health and other systemic diseases**
- **Tooth loss/periodontal health and quality of life**
- **Monitor disease at jurisdiction level where interventions can occur**
  - **Information for resource allocation**
  - **Evaluation of prevention programs**

U.S. National Objective on Periodontal Disease

- Objective 21.5: "Reduce destructive periodontal disease in adults aged 35 to 44 years."
    – Baseline (1999-00): 20%
    – Target: 14%

- Prevalence in States, counties, cities?

HEALTHY PEOPLE 2010

Understanding and Improving Health
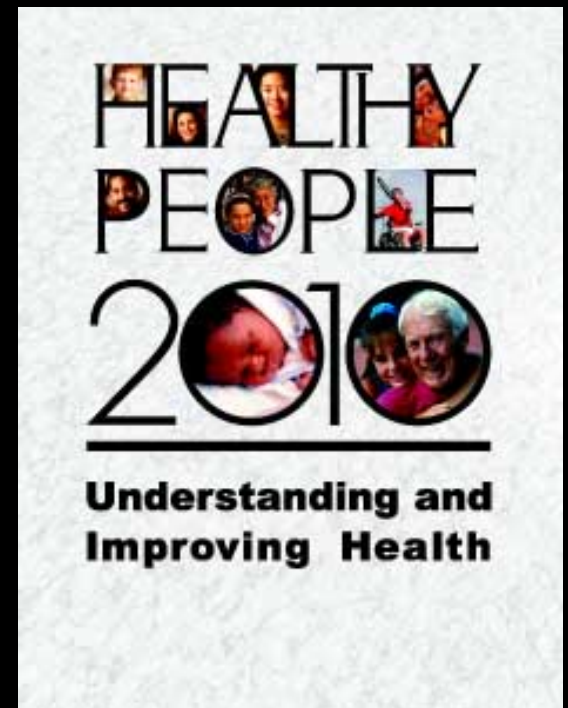
Traditional Approaches to Monitoring Periodontal Diseases in Populations

- Original data collection through clinical exams
- Array of clinical protocols, indexes, definitions
  - E.g., full mouth, half-mouth, sextants, selected teeth, varying # of sites per tooth
  - CAL, CPI, radiographic bone loss, other
- Sporadic surveys

Problems with Current Approach

- Resource intensive

- Few data at state/local level

- Not timely

- Questionable sustainability

Alternative Approaches to Periodontal Surveillance

- Existing clinical data, e.g. dental records
  - Inconsistent, limited accessibility

- Administrative / claims data
  - Misses uninsured; questionable relation between periodontal status and claims

- Sentinel surveillance, e.g. specific clinics
  - Limited generalizability; logistical issues

- Self-report

Some Conditions/Risk Factors Using Self-Reports for Surveillance

- Overweight/obesity
- Diabetes
- Hypertension
- Hypercholesterolemia
- Smoking
- Mammography
- Pap smear

The Behavioral Risk Factor Surveillance System (BRFSS)

- **Provides county and metropolitan level estimates**
- **Standardized**
  - **Allows state-to-state comparisons**
  - **Allows local area to local area comparisons**
- **Flexible**
  - **Addition of questions to address relevant topics**
- **Timely**
  - **Address urgent and emerging health issues**
- **Relatively inexpensive**
- **Technical details see: www.cdc.gov/brfss**

Uses for BRFSS

- **Tracking health risk trends**
- **Identify emerging health problems**
- **Program development**
- **Policy development**
- **Program evaluation**

Diabetes Trends Among U.S. Adults, BRFSS 1990, 1996, and 2003

1990
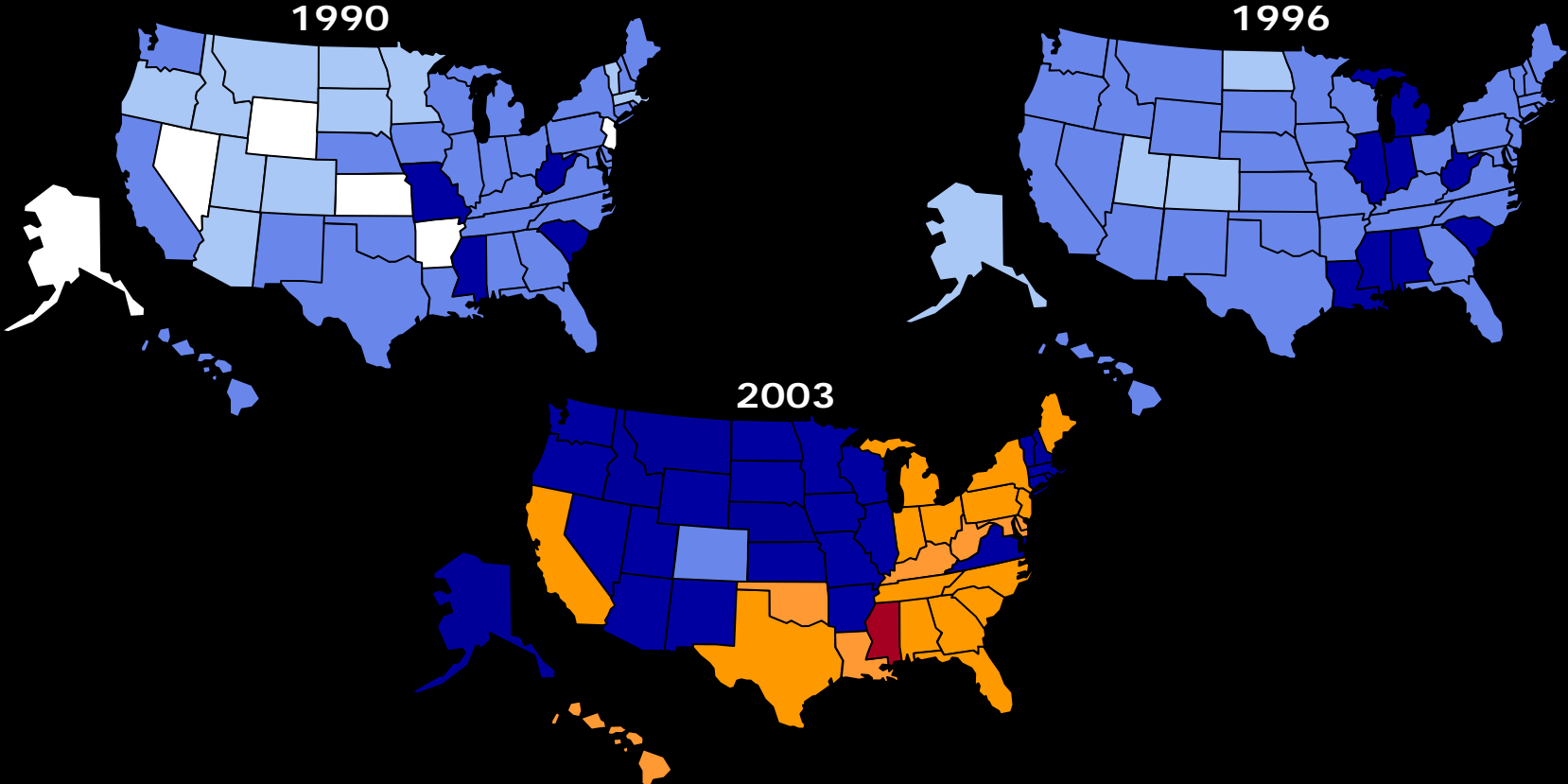
1996

2003

| | No Data | | <4% | | 4%–6% | | 6%–8% | | 8%–10% | | >10% |
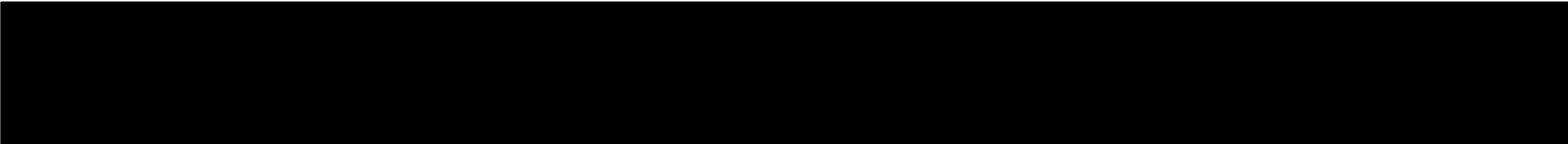
Obesity Trends Among U.S. Adults
BRFSS 1991, 1996, 2003
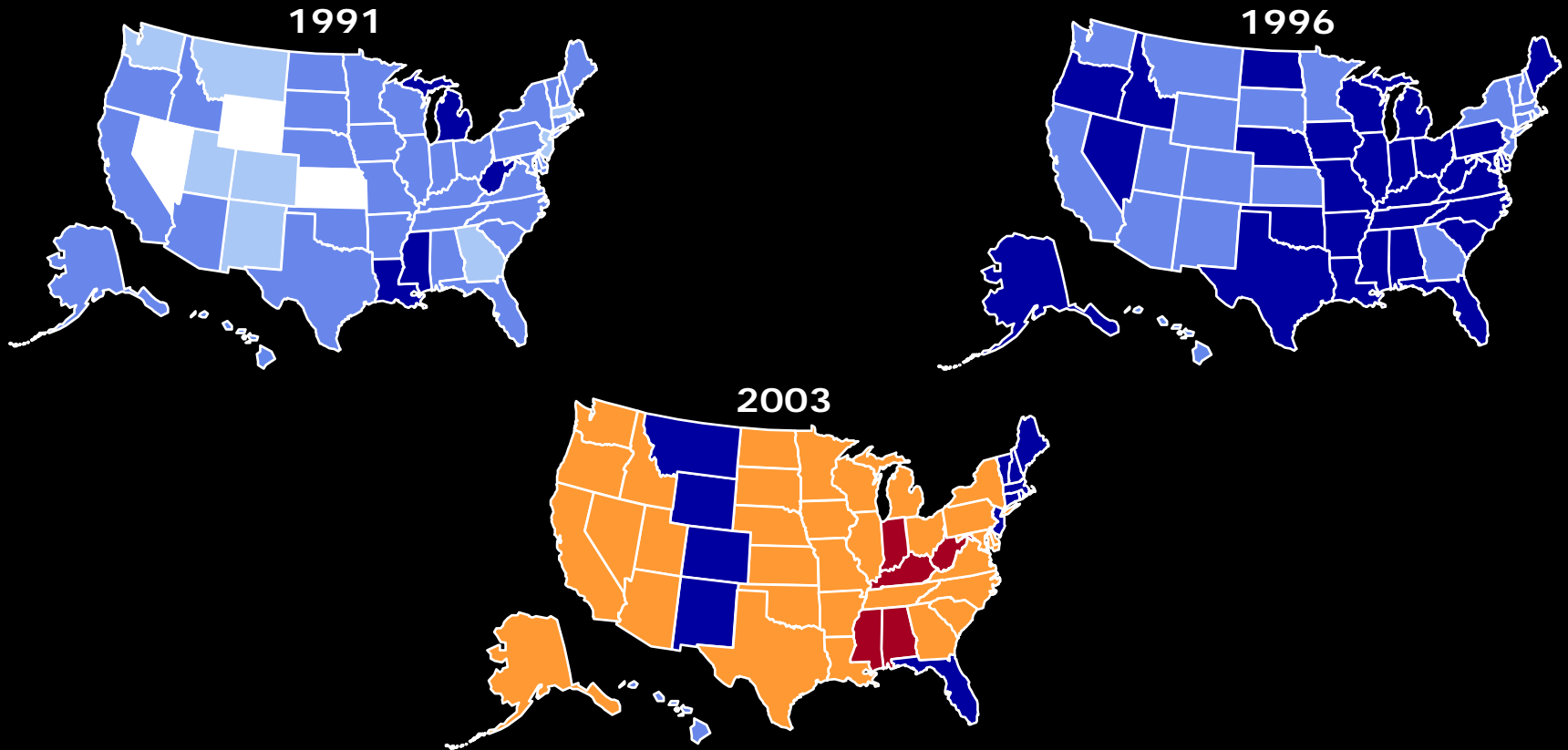
1991

1996

2003

No Data   <10%   10%-14%   15%-19%   20%-24%   ≥ 25%

Validity of Some Self-Reported Measures in the Behavioral Risk Factor Surveillance System (BRFSS)

- **Smoking** (vs. Cotinine levels in urine)
- Sensitivity 87.5%   Specificity 89.2%

- **Mammogram**
- Sensitivity 71 to 100%   Specificity 34% to 94%

- **Clinical Breast Examination**
- Sensitivity 88%   Specificity 59%

- **Pap Smear**
- Sensitivity 61 to 97% Specificity 19 to 76%
- *Sensitivity 98.7   Specificity 47.8% (Self-report among HMO)

- **Blood Pressure** (vs. medical records)
- Sensitivity 99%   Specificity   23%

Validity of Some Self-Reported Measures in the Behavioral Risk Factor Surveillance System (BRFSS)

- **Cholesterol Screening**
- Sensitivity 86%   Specificity 33%

- **Hypertension**
- Sensitivity 80%   Specificity 80 to 90%

- **Diabetes**
- Sensitivity >85%   Specificity >95% (K >0.80)
- *Sensitivity 73%   Specificity   99% (Self-report in HMO)

- **Hypercholesterolemia** (vs. measurements)
- Sensitivity   43%   Specificity 86%
- *Sensitivity 59%   Specificity 84%   (Self-report in HMO)

- **Colorectal Cancer Screening**: Blood stool test
- Sensitivity   92%   Specificity   71%

CDC Initiative on Surveillance for Periodontal Disease

- Began April 2003
- Goal:
  - Develop surveillance system for periodontal infections using self-reported measures;
  - Could include variables on signs, symptoms, behaviors, demographics, co-morbidities;
  - Primary focus is USA;
  - Outcomes should be at least state-specific and possibly county and local;
  - Ideally could yield subpopulation estimates

The Challenges

- Individual questions lack validity or reliability to use alone
- Needs to be relatively inexpensive
- Needs to be relatively brief
- Needs to be accepted as valid by clinicians, researchers, public
- Could multivariable modeling approach enhance validity?

Steps of Process

Step 1: Literature Review

Step 2: Identification of Datasets

Step 3: Development of Case Definitions

Step 4: Bivariate and Multivariable Analyses

Step 5: Field Testing of Promising Questions

Step 6: Develop Statistical Scoring Algorithm for U.S Population

Systematic Review: Validity of Self-Reported Periodontal Disease

- Total: 16 studies, 1966 – June 2004
  - 8 validated "periodontal disease", 13 validated gingivitis, 5 included both
  - Clinical "gold standard" varied widely
  - 20 questions assessed for validity of self-reported periodontal disease; 16 in review
- "Good validity": Sens + Spec ≥ 120% or PVP + PVN ≥ 120%
  - 13 of 16 perio. dis. measures considered valid
  - Few had high sens and high spec in gen'l pop.
  - 5 of those 13 valid for >1 clinical measure

Blicher, Joshipura, Eke. J Dent Res 2005;84(10):881-90.

Analyses of Data from Existing Studies

Data Sources

1. Predictors of Oral Health of African Americans (AADENT)

2. Periodontal Infections and Risk for Myocardial Infarction (MI-Perio)

3. The Buffalo and Erie County Periodontal Disease Study (Erie County)

4. The Florida Dental Care Study (Florida)

5. Nurses Health Study (NHS)

6. Health Professionals' Follow-up Study (HPFS)

7. The Accuracy of Self-reported Items to Determine Periodontal History (German)

Study Populations

Study	N	Age	%Female	%NHWhite
AADENT	455	18-93	57	46
MI-Perio	1,603	35-72	44	93
Erie Cty	1,426	25-74	52	90
Florida	873	45+	53	75
NHS	392	40-80	100	91
HPFS	424	46-86	0	85
German	246	20-80	59	~100

Clinical Case Definitions

- **<u>Severe periodontitis</u>:**

  ≥ 2 interproximal sites (not on same tooth) with ≥ 6 mm CAL
  AND
  ≥ 1 interproximal site(s) with PPD ≥ 5 mm

- **<u>Moderate periodontitis:</u>**

  ≥ 2 interproximal sites with ≥ 4 mm CAL (not on same tooth)
  OR
  ≥ 2 interproximal sites with ≥ 5 mm PPD (not on same tooth)

- **<u>No/Mild periodontitis:</u> Neither moderate nor severe**

Radiographic Case Definitions

•**<u>Severe periodontitis:</u>**

≥ 2 interproximal sites (not on same tooth) with ≥ 6 mm radiographic bone loss (bite-wing or periapical exposures)

or

≥ 2 interproximal sites (not on same tooth) with ≥ 7 mm radiographic bone loss (panoramic exposures)

•**<u>Moderate periodontitis:</u>**

≥ 2 interproximal sites (not on same tooth) with ≥ 4 mm radiographic bone loss (bite-wing or periapical exposures)

or

≥ 2 interproximal sites (not on same tooth) with ≥ 5 mm radiographic bone loss (panoramic exposures)

Prevalence of Periodontitis (%)

Study	N	No/Mild	Moderate	Severe
AADENT	455	64	24	12
MI-Perio	1,603	19	52	30
Erie Cty	1,426	27	42	31
Florida	873	N/A	N/A	35
NHS	392	46	48	6
HPFS	424	43	49	8
German	246	34	51	15

Perio-related BRFSS Variables

- Age
- Gender
- Race
- Education
- Employment status
- Annual household income
- Been told by doctor to have diabetes
- Self-rated general health
- Cigarette smoking
- Tooth loss
- Length of time since last dental visit for any reason
- Length of time since last dental cleaning

Types of Periodontal Health-related Self-report Variables Used

- Bleeding
- Think have perio dz
- Loose teeth
- Malodor / bad taste
- Noticed change
- Oral hygiene aid use
- Number of teeth
- Pain / discomfort

- Previous diagnosis
- Use of rinses
- History of perio tx
- Self-rating of gingival health
- Widening of spaces

Analysis Methods

Dichotomous Case Definitions

1. [None/Mild periodontitis] vs. [Moderate or Severe periodontitis]

2. [None/Mild or Moderate periodontitis] vs. Severe periodontitis]

Methods: Statistical Analyses

Manual logistic regression model development

SAS automated selection routines to perform logistic regression analyses:
- Forward selection routine
- Backward selection routine
- Stepwise selection routine
- Score selection routine

Criteria for Model Assessment

- C-statistic
- Sensitivity
- Specificity
- False positive
- False negative
- Likelihood Ratio Chi Square
- R-square

Predictors of Oral Health of African Americans (AADENT)

School of Dentistry &

Institute for Social Research

University of Michigan

AADENT

No/Mild Periodontitis
vs.
Moderate or Severe Periodontitis

[No/Mild Periodontitis] vs [Moderate or Severe] Best of the "Best" Unforced Models

	4V	5V	6V	7V	8V
• C-statistic	0.84	0.85	0.85	0.85	0.85
• Sensitivity	73	77	77	75	76
• Specificity	75	77	79	78	79
• LR ChiSquare	160	168	172	175	180
• R-square	0.30	0.32	0.32	0.33	0.33

VARIABLES

	4V	5V	6V	7V	8V
• Think gum disease	X	X	X	X	X
• Noticed tooth	X	X	X	X	X
• Age	X	X	X	X	X
• Smoke	X	X	X	X	X
• Race		X	X	X	X
• Painful gums			X	X	X
• Rinse				X	X
• Gender					X

AADENT

No/Mild or Moderate Periodontitis
vs.
Severe Periodontitis

[No/Mild or Moderate Periodontitis] vs. [Severe]
Best of the "Best" Unforced Models

	4V	5V	6V	7V	8V
• C-statistic	0.90	0.90	0.91	0.92	0.93
• Sensitivity	84	84	88	89	89
• Specificity	81	82	80	82	82
• LR ChiSquare	110	118	126	134	137
• R-square	0.21	0.23	0.24	0.26	0.27

VARIABLES

	4V	5V	6V	7V	8V
• Noticed tooth	x	x	x	x	x
• Loose tooth	x	x	x	x	x
• Age	x	x	x	x	x
• Gender	x	x	x	x	x
• Stimudents		x	x	x	x
• Rinse			x	x	x
• Think gum disease				x	x
• Problems brushing					x

Summary of results from all studies

NO/MILD vs MOD_SEV	AADENT	MI-Perio	Erie County	NHS	HPFS	German
Age	x	x	x	x	x	x
Race	x	x	x	x	x	
Smoking	x	x	x	x	x	x
Gender		x	x			x
Diabetes		x	x	x	x	
Think have gum disease	x					
Noticed tooth not looking right	x					
Painful gums	x					
Gum surgery in the past		x	x			
Sore gums in the past		x				
Scaling in the past		x				
Bleeding gums now			x			
Perio classification				x	x	
Have periodontitis				x		
Number of teeth				x	x	
Loose tooth						x
Periodontal treatment, ever						x
Malodor/bad taste						x

Model Performance Statistics for [No/Mild] vs. [Moderate or Severe] Periodontitis

	AADENT	MI-Perio	Erie County	NHS	HPFS	German
C-statistic	0.85	0.76	0.74	0.89	0.77	0.83
Sensitivity	77%	87%	67%	82%	51%	78%
Specificity	79%	49%	67%	54%	77%	77%
Se+ Sp	156	136	134	136	128	155

[No/Mild or Mod] vs Severe	AA-DENT	MI-Perio	Erie County	FDCS	NHS	HPFS	German
Think have gum disease	x						
Noticed tooth not looking right	x						
Gum surgery in the past			x				
Sore gums now			x				
Sore gums in the past		x					
Scaling in the past		x					
Perio classification					x	x	
Number of teeth				x			
Loose tooth	x			x			x
Perio surgery in past 2 yrs		x					
Use Stimudents	x						
Use rinse/mouthwash	x				x		
Problems brushing	x						
Chewing satisfaction			x				
Self-rating of health of gums				x			
Problem-oriented dental utiliz				x			
Tooth loss due to perio dz						x	
Other oral hygiene						x	
Space between teeth wider							x
Malodor/bad taste							x

[No/Mild or Mod] vs [Severe] Periodontitis

	AA-DENT	MI-Perio	Erie County	FDCS	NHS	HPFS	German
Age	x	x	x		x	x	x
Race		x	x	x	x	x	
Smoking		x	x		x	x	x
Gender	x	x	x	x			x
Diabetes		x	x	x	x	x	
High school grad.				x			

Model Performance Statistics for
[No/Mild or Moderate] vs. [Severe] Periodontitis

	AA-DENT	MI-Perio	Erie County	FDCS	NHS	HPFS	German
C-statistic	0.93	0.76	0.75	0.80	0.93	0.97	0.88
Sensitivity	89%	68%	65%	76%	82%	99%	58%
Specificity	82%	67%	69%	68%	71%	25%	92%
Se + Sp	171	135	134	144	153	124	150

Summary and Conclusions

- Trends among variety of studies suggest validity of self-report for periodontal disease presence

- Consistency
  - Different populations
    - Health professionals
    - Community dwelling elders
    - Community dwelling adults of all ages
    - Patients with heart disease
    - Patients requiring endodontic treatment
    - Race / Ethnicity

Summary and Conclusions, cont'd.

- Different assessment methods
  - Varied clinical periodontal exam measures
  - Varied radiographic measures
- Different geographic areas
  - Rural vs urban

Periodontal Screening Questions
to Test Further

Questions   **Response categories**

Do you think you have gum disease?   *Yes/No/Don't know*

Has a dental professional ever told you that
you have lost bone around your teeth?   *Yes/No/Don't know*

Have you ever had scaling, root planing,
surgery or other treatment for gum disease?   *Yes/No/Don't know'*

Have you ever had any teeth that have become
loose by themselves without some injury
(not baby teeth)?   *Yes/No/Don't know*

How often during the last seven days did you
use mouthwash or any dental rinse product?   *Literal response*

Periodontal Screening Questions
to Test Further, cont'd

Questions

Response categories

How often during the last seven days did you use dental floss, tape or interdental brush to clean between your teeth, other than just to remove food particles stuck between your teeth?

Literal response
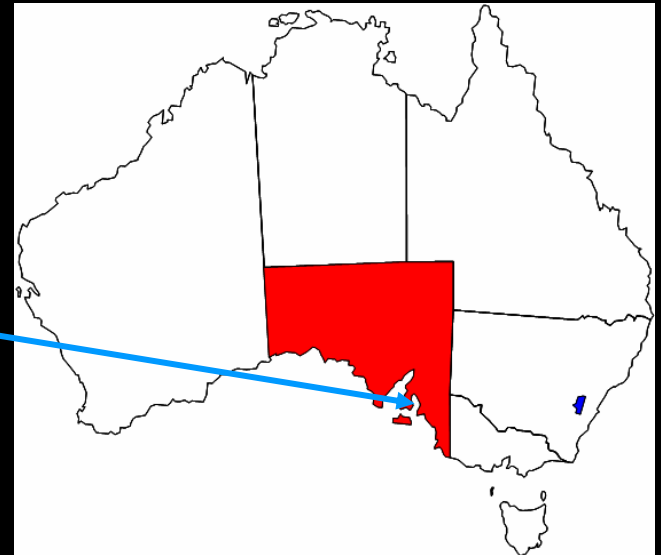
How would you rate the health of your gums?

Excellent / VG / G / F / Poor

Have you noticed that you have a tooth that doesn't look right?

Yes/No/Don't know

Next step: Validation pilot

- Australian Research Center for Population Oral Health

- National Survey of Adult Oral Health, 2004/06
  - Gary Slade, University of Adelaide
  - CDC

Six states, two territories
Population 20 million
~65% of population resides
 in 8 capital cities

Darwin

Brisbane

Sydney

Adelaide

Canberra

Melbourne

Hobart
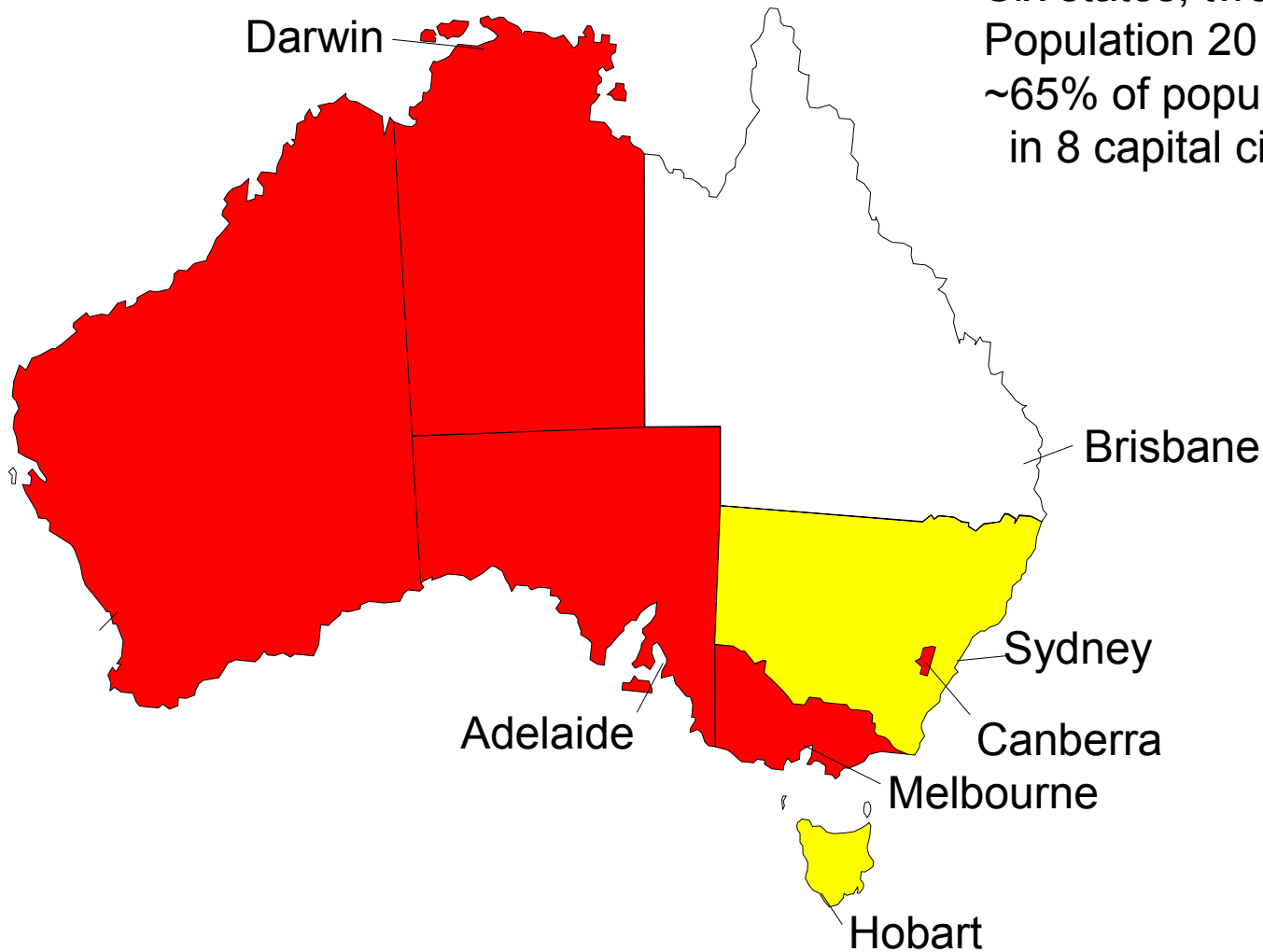
Data for this interim analysis
Data collection completed
Data collection underway
Data collection scheduled

Australian National Survey of Adult Oral Health: Overview of survey methods

- Sampling – three stage, clustered design
  - Metropolitan, regional and rural areas

- Computer-assisted telephone interviews (CATI) of 13,560 people, ages 15 +

- Oral examination of those interviewed

CATI, 69 questions, 15 min

- Oral health status
  - Tooth loss, self-rated oral health, dental pain and other symptoms
  - Questions screening for periodontal disease
- Pattern of past dental visits
  - Waiting time for last dental visit
  - Dental treatments received in last 12 months
- Perceived need for dental care
- Barriers to receipt of dental care
- Dental insurance and eligibility for public dental services
- Socio-economic factors

Examination procedures

- Conducted at public health department clinics

- Based on US National Health and Nutrition Examination Survey 2004 and UK Adult Dental Health Survey 1998

- Periodontal (gum) assessment
  – Plaque, gingivitis and calculus on six teeth
  – Periodontal recession and pocket depth at three sites on all teeth excluding 3rd molars

Periodontal Screening Questions
Tested for CDC Working Group

Questions   Response categories

Do you think you have gum disease?   *Yes/No/Don't know*

Has a dental professional ever told you that
you have lost bone around your teeth?   *Yes/No/Don't know*

Have you ever had scaling, root planing,
surgery or other treatment for gum disease?   *Yes/No/Don't know'*

Have you ever had any teeth that have become
loose by themselves without some injury
(not baby teeth)?   *Yes/No/Don't know*

How often during the last seven days did you
use mouthwash or any dental rinse product?   *Literal response*

Periodontal Screening Questions
Tested for CDC Working Group, cont'd

Questions   Response categories

How often during the last seven days did you
use dental floss, tape or interdental brush to
clean between your teeth, other than just to
remove food particles stuck between your
teeth?   *Literal response*

How would you rate the health of your gums?   *Excellent / VG / G / F / Poor*

Have you noticed that you have a tooth that
doesn't look right?   *Yes/No/Don't know*

Participation in the survey
(through 3 Mar 2006)

No. of people interviewed (to 03Mar06)   11,019
    Edentulous   953
    Dentate but out of scope for exam   179
    Dentate and in scope for exam   9,887

    No. in scope who said "OK" to further
contact for examination   7,921
                                       (80% of 9,887)

No. of dentate people contacted
who completed an examination*   3,855
                                       (49% of 7,921)

No. of dentate people with periodontal
assessment used in interim analysis   2,999