Session 56, Why Health Actuaries Need to Care About Public Health and an Update of Social Security

SOA Antitrust Disclaimer
SOA Presentation Disclaimer

2019 Health Meeting

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Session 056: Public Health Outcomes Related to Why Dental Care is Critical to Health and Wellbeing

June 24, 2019

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SOCIETY OF ACTUARIES
Antitrust Compliance Guidelines

Active participation in the Society of Actuaries is an important aspect of membership. While the positive contributions of professional societies and associations are well-recognized and encouraged, association activities are vulnerable to close antitrust scrutiny. By their very nature, associations bring together industry competitors and other market participants.

The United States antitrust laws aim to protect consumers by preserving the free economy and prohibiting anti-competitive business practices; they promote competition. There are both state and federal antitrust laws, although state antitrust laws closely follow federal law. The Sherman Act is the primary U.S. antitrust law pertaining to association activities. The Sherman Act prohibits every contract, combination or conspiracy that places an unreasonable restraint on trade. There are, however, some activities that are illegal under all circumstances, such as price fixing, market allocation and collusive bidding.

There is no safe harbor under the antitrust law for professional association activities. Therefore, association meeting participants should refrain from discussing any activity that could potentially be construed as having an anti-competitive effect. Discussions relating to product or service pricing, market allocations, membership restrictions, product standardization or other conditions on trade could arguably be perceived as a restraint on trade and may expose the SOA and its members to antitrust enforcement procedures.

While participating in all SOA in person meetings, webinars, teleconferences or side discussions, you should avoid discussing competitively sensitive information with competitors and follow these guidelines:

- **Do not** discuss prices for services or products or anything else that might affect prices.
- **Do not** discuss what you or other entities plan to do in a particular geographic or product market or with particular customers.
- **Do not** speak on behalf of the SOA or any of its committees unless specifically authorized to do so.
- **Do** leave a meeting where any anticompetitive pricing or market allocation discussion occurs.
- **Do** alert SOA staff and/or legal counsel to any concerning discussions.
- **Do** consult with legal counsel before raising any matter or making a statement that may involve competitively sensitive information.

Adherence to these guidelines involves not only avoidance of antitrust violations, but avoidance of behavior which might be so construed. These guidelines only provide an overview of prohibited activities. SOA legal counsel reviews meeting agenda and materials as deemed appropriate and any discussion that departs from the formal agenda should be scrutinized carefully. Antitrust compliance is everyone's responsibility; however, please seek legal counsel if you have any questions or concerns.

Presentation Disclaimer

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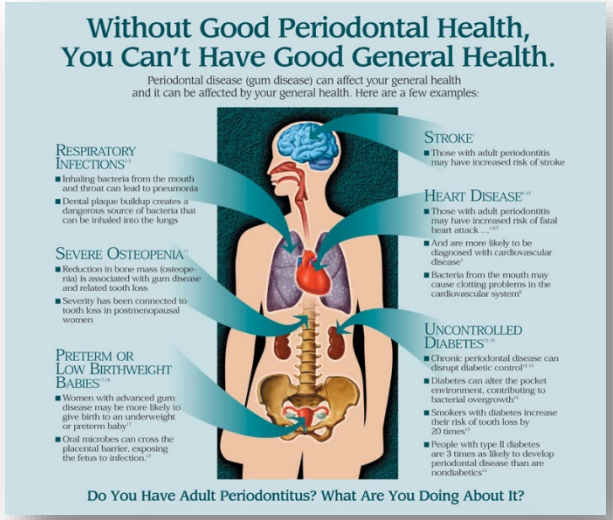
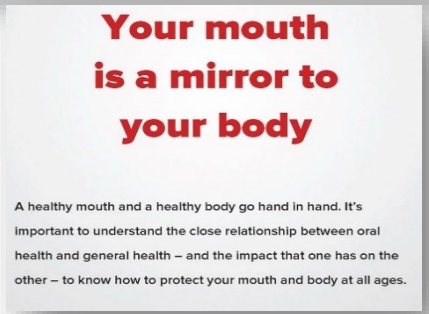
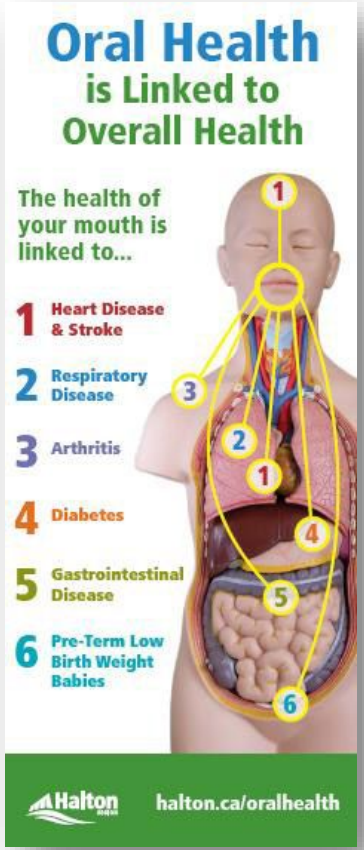
Agenda

- Why dental care is important/links to overall health
- How research translates to reality
- What does the future hold for stakeholders in the oral/overall health discussion

Oral Health and Overall Health





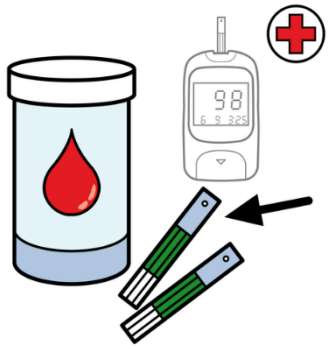


Oral and Overall Health: The Research

- Diabetes
- Cardiovascular disease (CVD)
- Chronic obstructive pulmonary disease (COPD)
- Stroke
- Pre-term or low birth weight babies
- Other

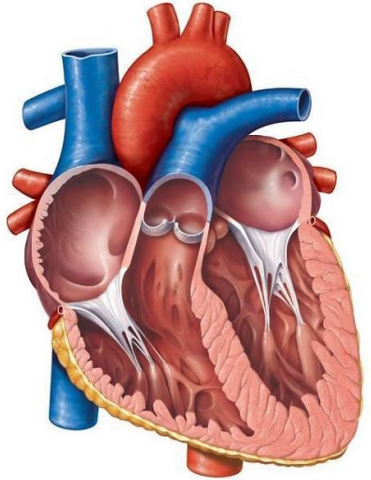
Oral and Overall Health: Type 2 Diabetes

- Well established link in clinical literature
- Periodontal (gum) changes can be first clinical sign of diabetes
- Increasing but not uniform evidence on periodontal treatment impact on diabetes incidence/severity/control
- Diabetes is prevalent and expensive ->
  small changes can be worth big $



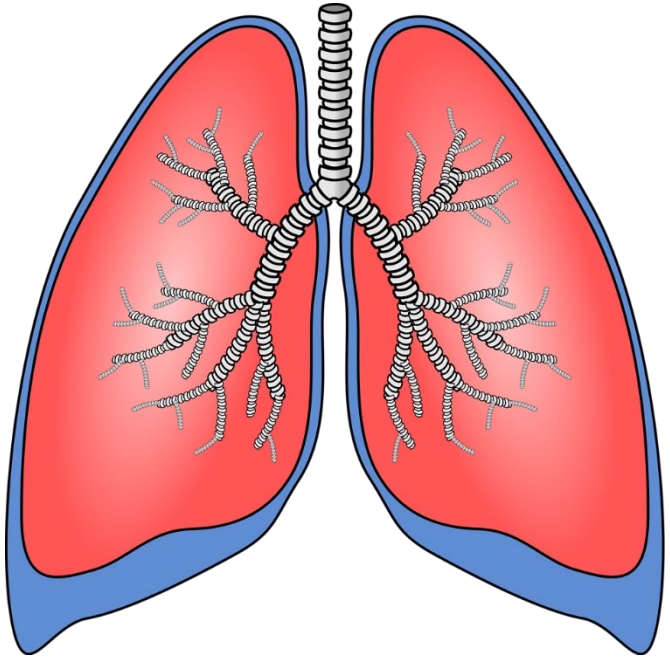
Oral and Overall Health: Heart Disease (CVD)

- Clinical studies suggest correlation
- Patients receiving periodontal treatment showed lower onset and progression of CVD
- Adults with medium or high CVD risk much more likely to have periodontal disease and/or poor oral hygiene habits/fewer preventive dental treatments
- CVD is prevalent and expensive -> small changes can be worth big $



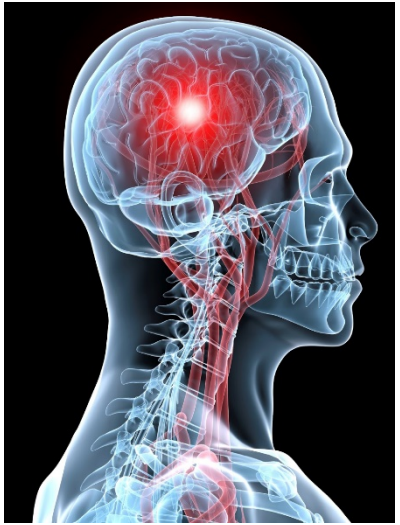
Oral and Overall Health: COPD

- Clinical studies strongly support correlation
- E.g. in one study “markers of dental health correlate with daily respiratory symptoms in COPD”
- Did not find cause/effect studies
- COPD is prevalent and expensive -> small changes can be worth big $



Oral and Overall Health: Stroke

- Clinical studies suggest correlation between gum disease and stroke risk
- Regular dental care associated with lower stroke risk
- Periodontal disease characterized by increased inflammation had strongest association with stroke risk (2-3x increase)



Oral and Overall Health: Pregnancy

- Periodontitis associated with preterm birth and low birth weight
- Some evidence that periodontal treatment may help prevent issues
- Oral health can worsen during pregnancy and exacerbate potential issues

Oral and Overall Health: Many More!

- Pneumonia
- Cancer
- Kidney disease
- Hypertension
- "Periodontal disease is a chronic inflammatory disease caused by bacterial colonization…about half of Americans aged 30 years or older have periodontitis"*

*Hughes, Sue. "More Evidence Links Gum Disease to Stroke Risk". Jan 19, 2018. www.medscape.com

Oral and Overall Health: Insurer Study

- United Concordia Impact of Periodontal Therapy on General Health
- "treatment of gum disease may lessen the adverse consequences of some chronic systemic conditions"
- Studied diabetes, coronary artery disease, cerebral vascular disease, rheumatoid arthritis, pregnancy
- Used insurance claims, categorized patients by disease and by whether they had completed periodontal treatment
- Dramatic results…..

Condition	Reduction in Total Medical Cost For Those with Perio Treatment
Diabetes	40.2%
Cerebral Vascular Disease	40.9%
Coronary Artery Disease	10.7%
Pregnancy	73.7%

Oral and Overall Health: Insurer Study

- United Concordia The Value of Going to the Dentist
- 2014 study in conjunction with UPenn School of Dental Medicine
- "Are medical cost savings possible simply by visiting the dentist regularly…absent a chronic medical condition?"
- Analyzed 489K medical/dental insureds
- Study participants who visited dentist routinely have associated medical cost savings of $68 annually
- Adjusted for baseline health status and medical conditions as well as age/gender/income

Oral and Overall Health: The Reality

Correlation Causation

Clinical or Commercial Study Results Results in Real World Settings

Oral and Overall Health: The Reality

- It's my personal opinion that oral health can affect overall health and disease management/progression, and that there is long term $ to be saved in public programs by incorporating oral health components
- Studies done in clinical or commercial insurer settings don't automatically translate to public health space – unlikely to see immediate massive medical cost savings
- To succeed, NEED:
  - ✓ Consistency of dental benefit coverage over time and space
  - ✓ Access to dental providers
  - ✓ Coordinated management of care – total body
  - ✓ Ongoing commitment to cause
- Given prevalence and cost of chronic medical conditions, and given the potential for oral care to affect disease progression - I might bet on it!

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Profiles of US Adults Based on Social Determinants and their Impact on Oral Health Outcomes and Health Expenditures

Margie Rosenberg and Fanghao Zhong

University of Wisconsin – Madison

We acknowledge the Society of Actuaries CAE Research Grant for their partial support and Joshua Agterberg and Richard Crabb as co-authors for portions of this work.

Public Health 3.0

“Recognizes the need to focus on social determinants of health to create lasting improvements for the health of everyone in the US.

...Public health is what we do together as a society to ensure the conditions in which everyone can be healthy.

... When we build a complete infrastructure of healthy communities, we can begin to close the gaps in health due to race or ethnicity, gender identity or sexual orientation, zip code or income.”

`https://www.healthypeople.gov/sites/default/files/Public-Health-3.0-White-Paper.pdf`

Purpose of Presentation

Using a novel way of grouping *similar* individuals including only social determinants, we examine these clusters with respect to insurance coverage, medical and dental expenditures, and oral health need

Outline

1. Cluster Method
2. Data
3. Results
4. Conclusions

Clustering: An Unsupervised Learning Approach

- Outcome of procedure is cluster
- No outcome variable to validate
- Way of succinctly collapsing data
- Combines data in way that captures latent relationships among variables

Sneath and Sokal (1973)

Approach: Want to group individuals who are *similar*

- Data need to be definable and defensible
- Data need to be measurable
- Reproducible process
- Interpretable clusters with characteristics generally constant
- Manageable number of clusters
- Predictive power of cluster

Evans, Pope, Kautter, Ingber, Freeman, Sekar, and Newhart (2011); Feinstein (1967, 1988);

Fetter, Shin, Freeman, Averill, and Thompson (1980); Sneath and Sokal (1973)

Clustering Principles

- Based on similarity
- More information available for clustering, the better
- Overall similarity between 2 individuals is function of individual-level similarity of each variable
- Distinct groups recognized due to correlation of variables within each group
- Inferences valid from developed clusters (originally based on biology)
- Want cluster **compactness** and cluster **separation**
- End goal: Want similar individuals grouped together and non-similar individuals not grouped together

Sneath and Sokal (1973)

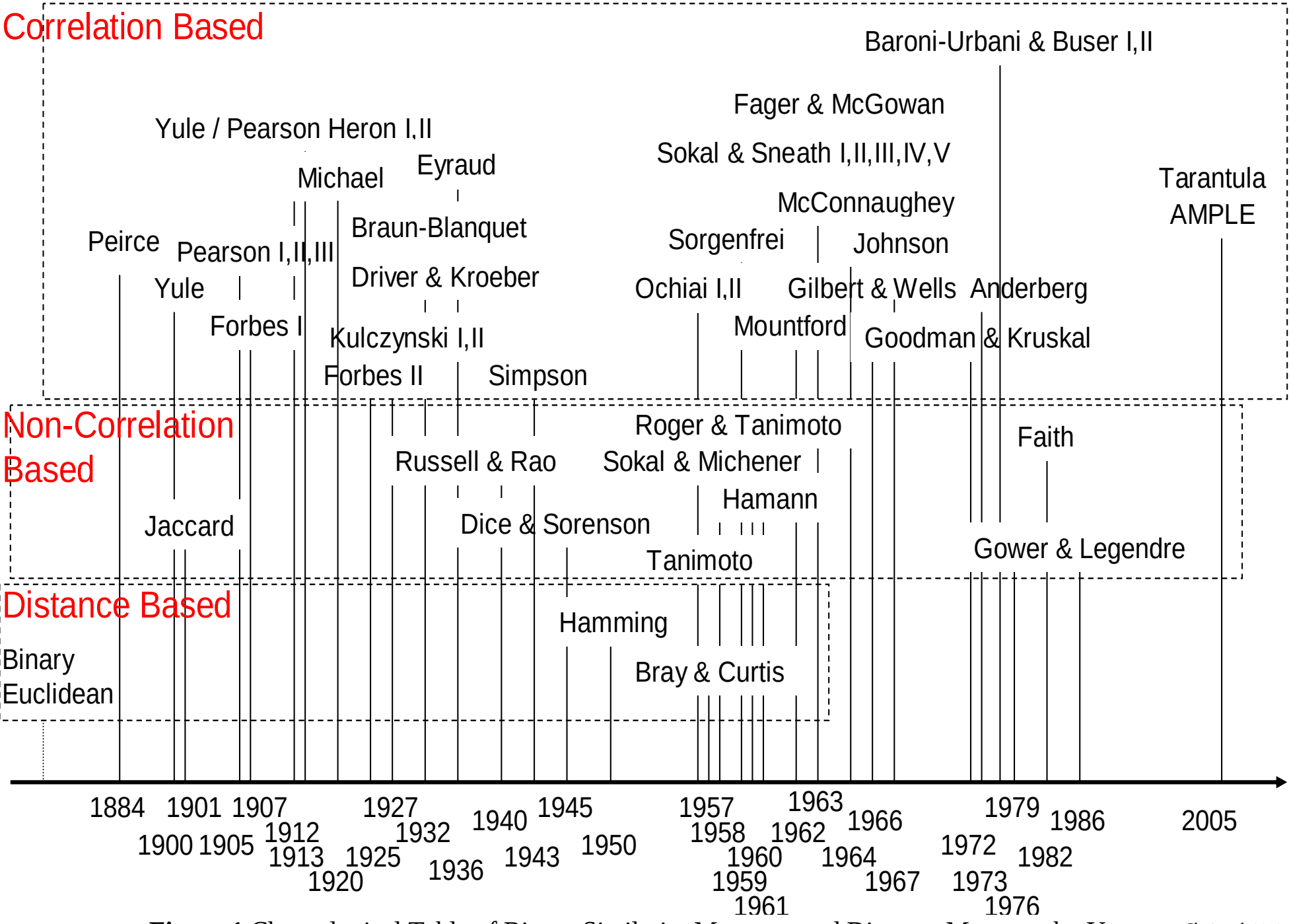
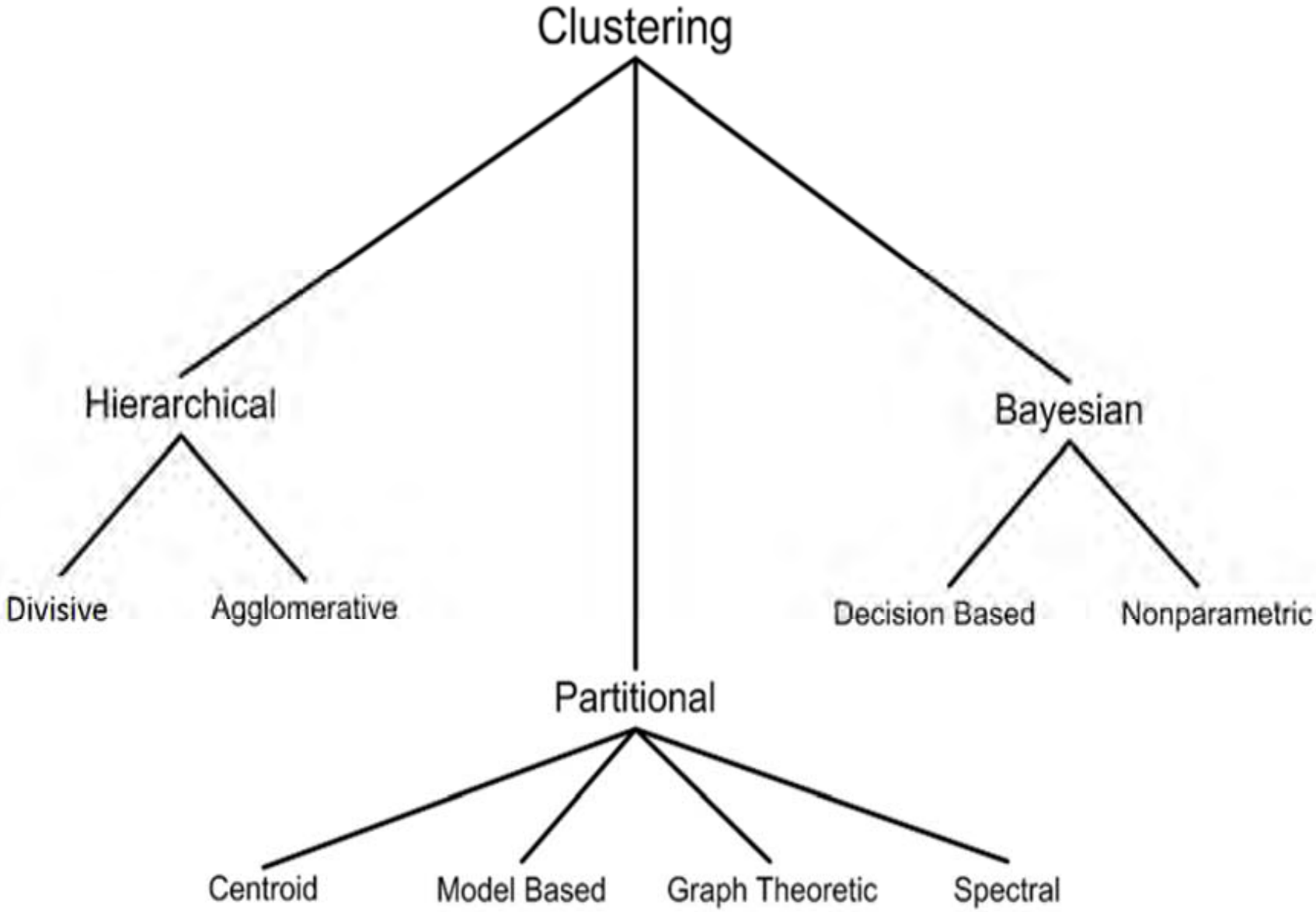


Figure 1 Chronological Table of Binary Similarity Measures and Distance Measures by Year

Choi et al. 2010



http://www.mit.edu/~9.54/fall14/slides/Class13.pdf

Our Cluster Protocol

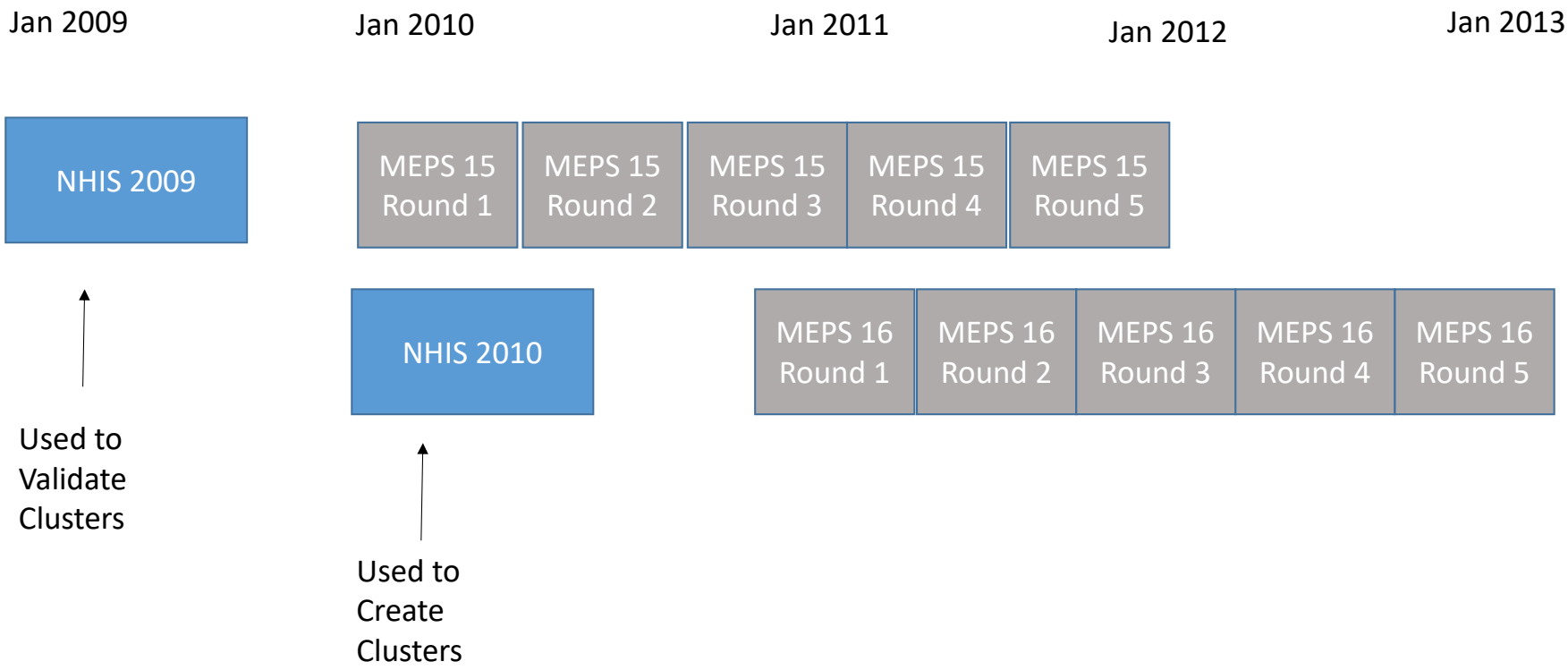
1. Define center as *medoid* (center represents actual data point)
2. General clustering algorithm: PAM (Partitioning Around Medoids), where medoid represents actual person
3. Similarity measure: Goodall 3 (modified version of original Goodall for computational ease), where *rare* matches are *more* similar than common matches
4. Include person-weights in analysis

Goodall (1964, 1966); Boriah, Chandola, and Kumar (2008)

NHIS/MEPS Data

- National Health Interview Survey (NHIS) linked to Medical Expenditure Panel Survey (MEPS)
- NHIS Sample Adult Questionnaire for adult health behavior data
- Complex survey design allowing estimates of US civilian non-institutionalized population

NHIS/MEPS


Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
NHIS 2009
MEPS 15 Round 1
MEPS 15 Round 2
MEPS 15 Round 3
MEPS 15 Round 4
MEPS 15 Round 5
NHIS 2010
MEPS 16 Round 1
MEPS 16 Round 2
MEPS 16 Round 3
MEPS 16 Round 4
MEPS 16 Round 5
Used to Validate Clusters
Used to Create Clusters

Study Design

- Persons between 20 and 59 inclusive
- Baseline
  - NHIS baseline year 2010: Individual-level characteristics define initial clusters
  - MEPS panel 16
- 2008 NHIS data
  - Clusters based on 2010 baseline medoids
  - Includes more specific oral health questions
  - MEPS panel 14

NHIS Variables for Clusters

- 2010 NHIS Data
  - 1172 original variables
  - Reduced to 70 variables and further collapsed to 51 variables to develop clusters
  - Changed to all categorical variables (like age, income, education)
  - Number of individuals: 3,948 representing 166,154,794 in US in 2010
- Missing Data: Created category for missing data
- **NOTE: Presence of insurance (medical or dental) NOT used in cluster formation**

NHIS Variables for Clusters

Demographics & Social Determinants	**Health Status**
Gender	General Health Status
Age	Mental Health
Race	Functional Limitations
Education	Comorbidities
Income	Pregnant
Parental Status	BMI/weight
Marital Status	Sleep
Occupation	Drinking
Geographic Region	Smoking
Born in US	Exercise
Homeless	

2008 NHIS Oral Health Questions

- Condition of mouth (VG, G, F, P, Missing)
- Self-conscious/embarrassed about mouth (often, sometimes, rarely, never, missing)
- Oral health problems (toothaches, bleeding gums, broken/missing teeth, loose teeth, pain in jaw, ...)
- Hours missed school/work (emergency dental care, routine dental care, taking someone else)
- Delay of care (did not see important, problem went away, not affordable, no transportation, ...)

2010 NHIS Data Description

Description	Levels	Weighted %
Gender	Male	50.04%
	Female	49.96%
Age	20-29	24.88%
	30-39	25.18%
	40-49	26.02%
	50-59	23.92%
Race	Non-Hispanic White	64.81%
	Hispanic	16.51%
	Non-Hispanic Black	12.33%
	Non-Hispanic Asian	5.60%
	Non-Hispanic All other race groups	0.75%

2010 NHIS Data Description

Description	Levels	Weighted %
Marital Status	Married	52.52%
	Never Married	30.55%
	Widow/Divorce/Separate	16.86%
	R/NA/DK	0.07%
Education	Never attended/kindergarten only	0.45%
	Did Not Complete High School/No Diploma	10.20%
	Completed High School or Equivalent	44.18%
	Associated Degree	11.06%
	Bachelor's Degree	22.23%
	Graduate Degree	11.62%
	R/NA/DK	0.25%

2010 NHIS Data Description

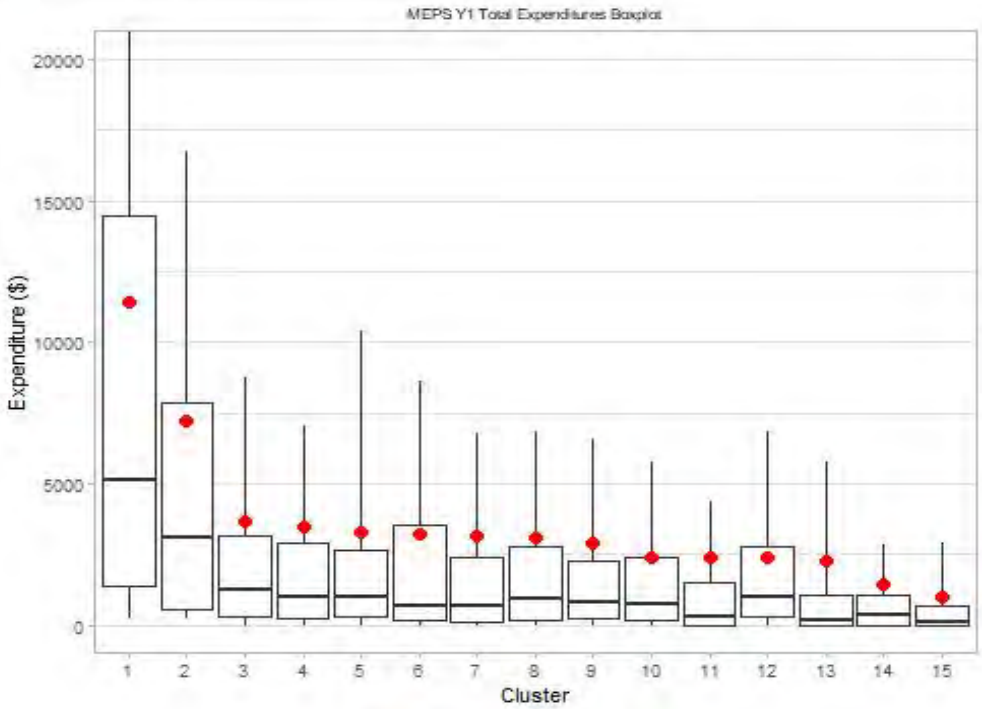
Description	Levels	Weighted %
Annual Income	$<$10,000	8.33%
	10,000-19,999	10.34%
	20,000-34,999	16.92%
	35,000-54,999	17.10%
	55,000-74,999	8.04%
	$>$75,000	9.60%
	R/NA/DK	29.66%
Food Stamps (Mo.)	0	91.97%
	1-11	2.86%
	12	5.12%
	R/NA/DK	0.06%
Homeless	Yes	8.00%
	No	89.48%
	R/NA/DK	2.52%

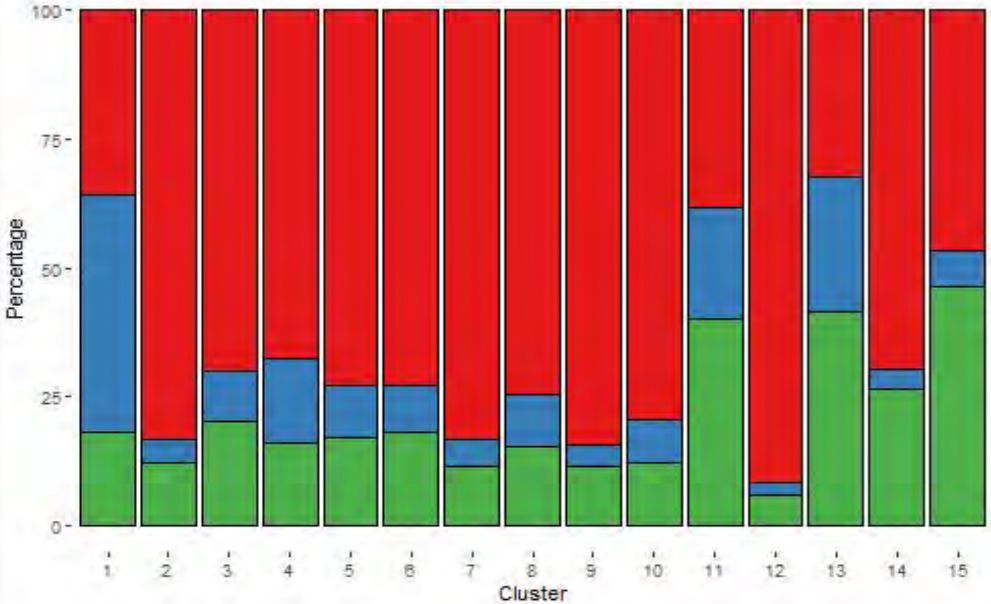
2010 NHIS Data Description

Description	Levels	Weighted %
Health Status	Excellent	29.02%
	Very good	35.70%
	Good	26.36%
	Fair	6.50%
	Poor	2.38%
	R/NA/DK	0.04%
# of Medical Conditions	0	36.95%
	1	24.38%
	2	16.69%
	3	9.94%
	4	4.96%
	5+	7.08%

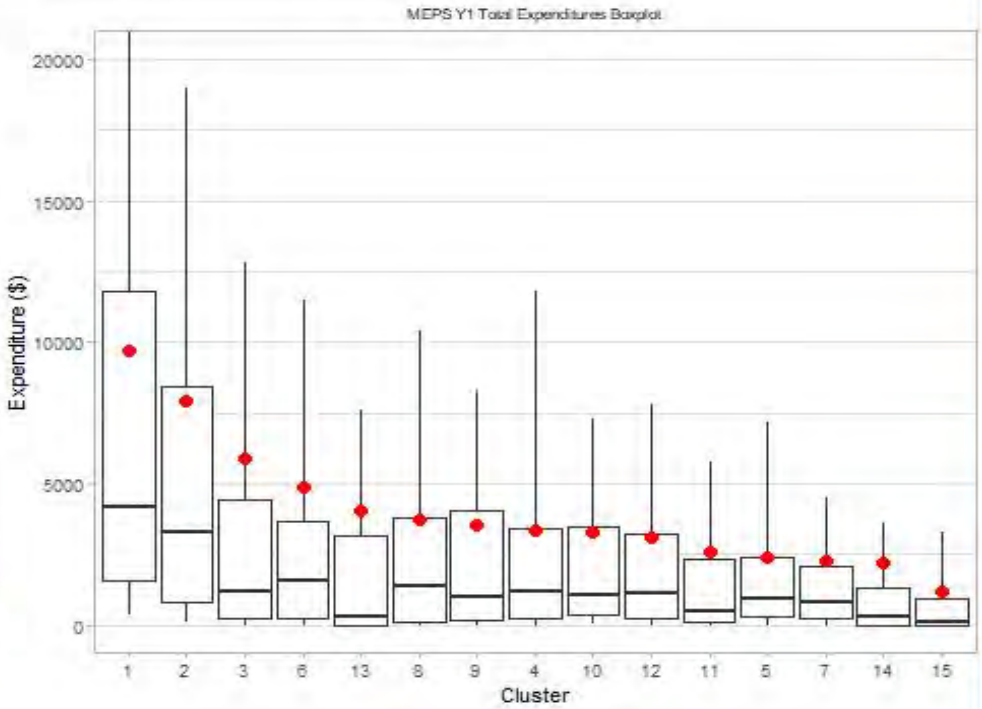
Sample of Results shown below;
More to follow at presentation

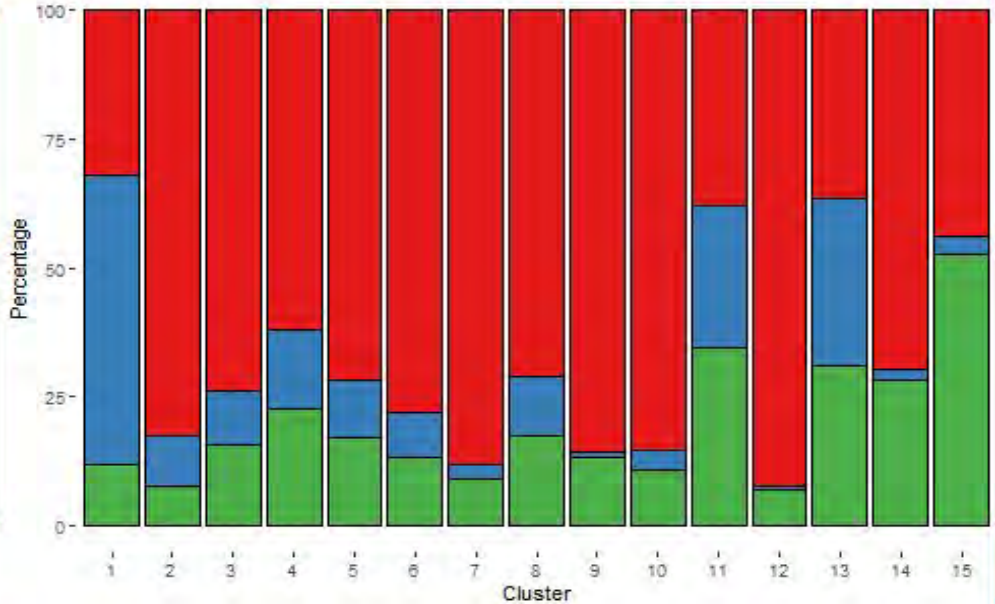
2010 NHIS





2008 NHIS





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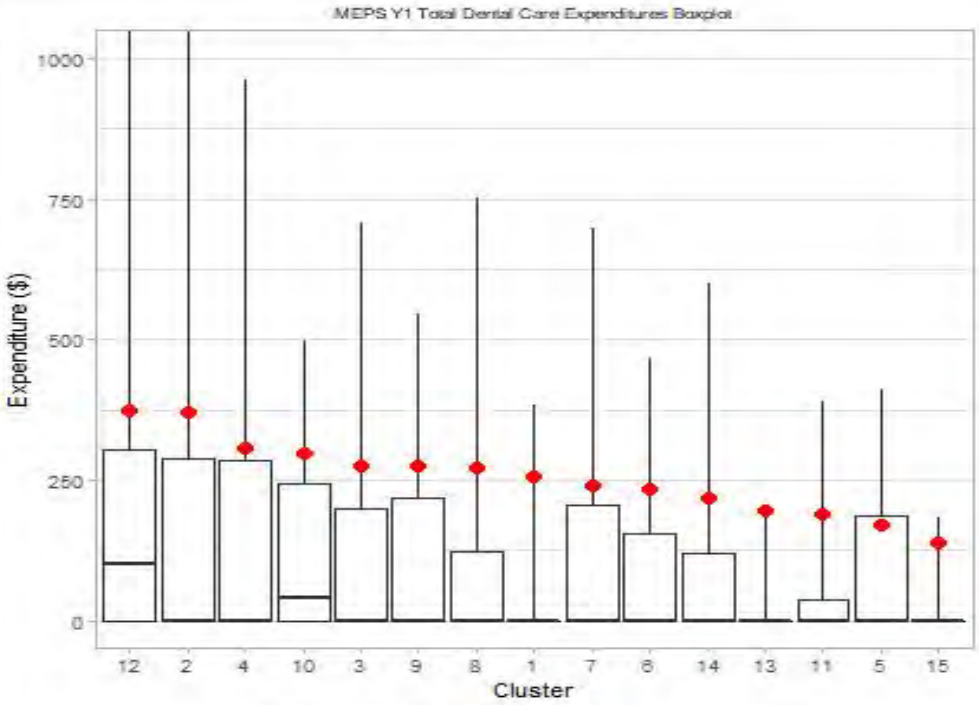

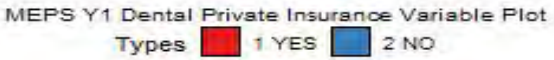

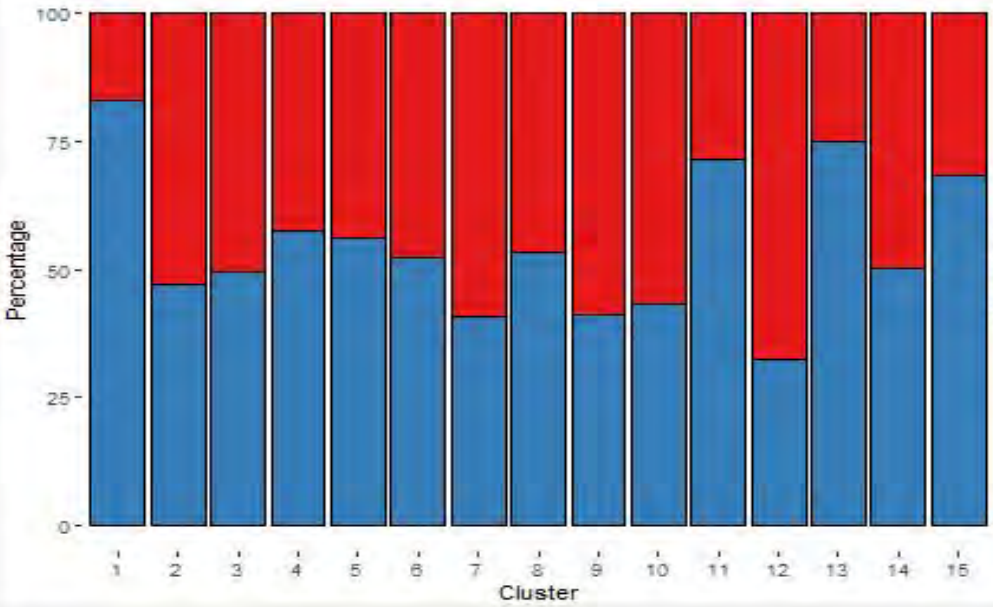

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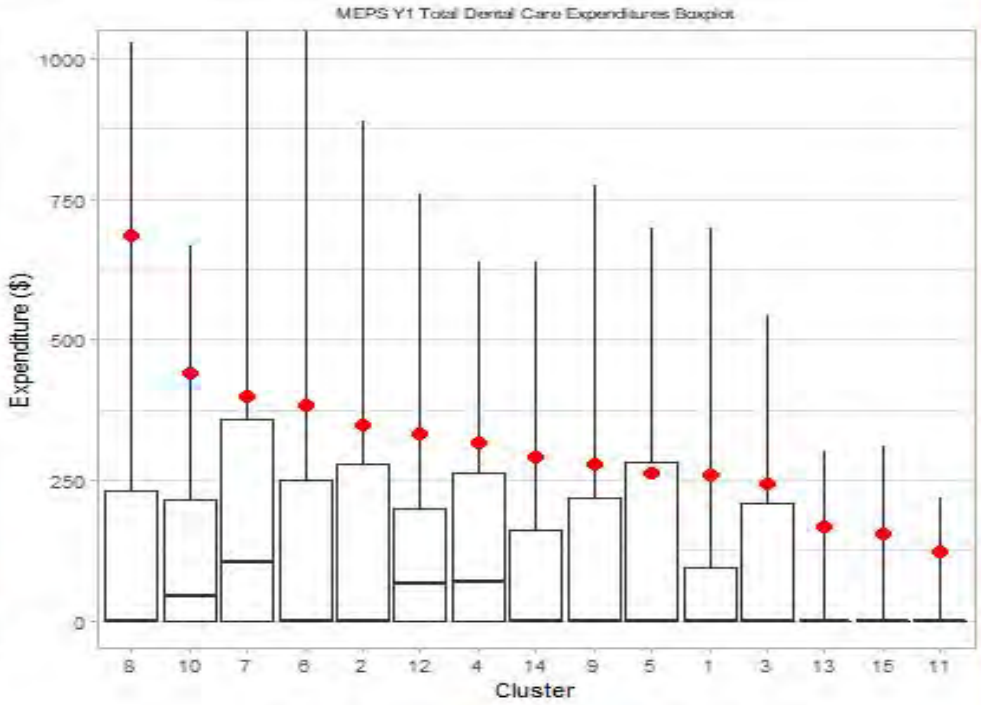

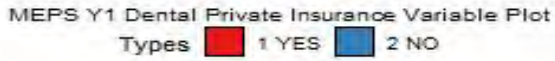

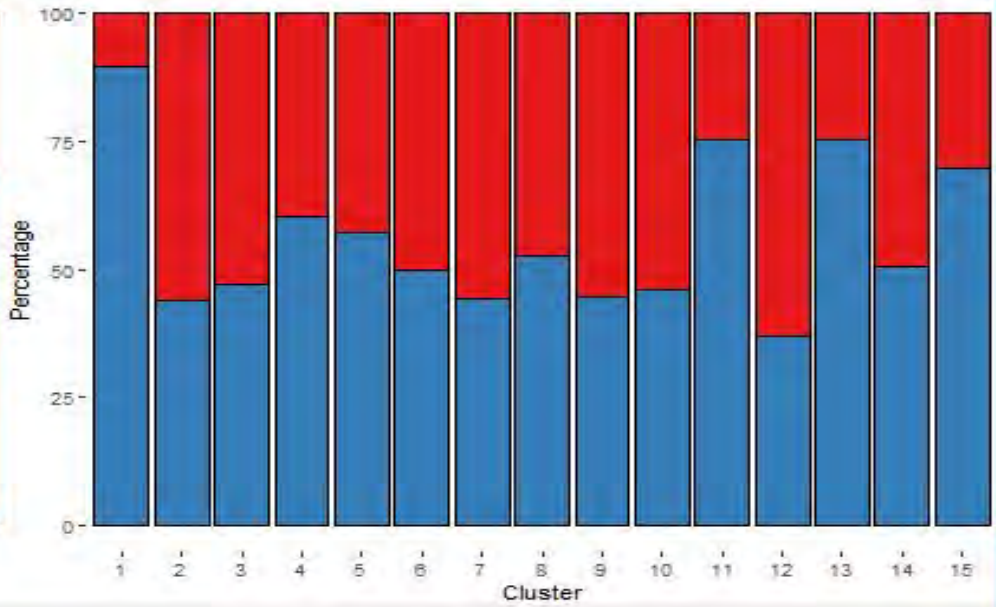

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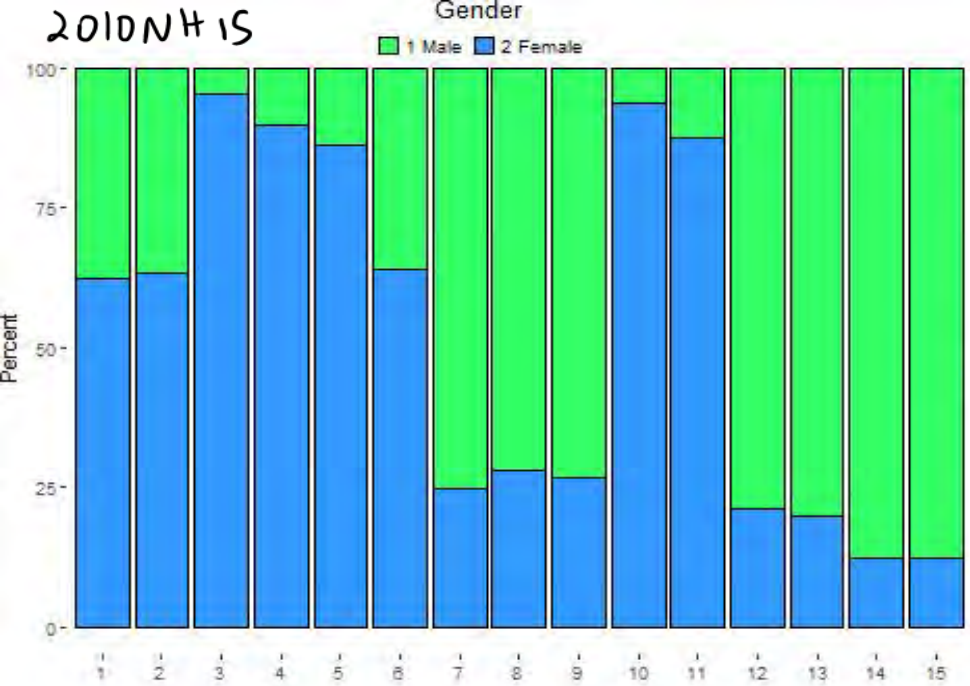

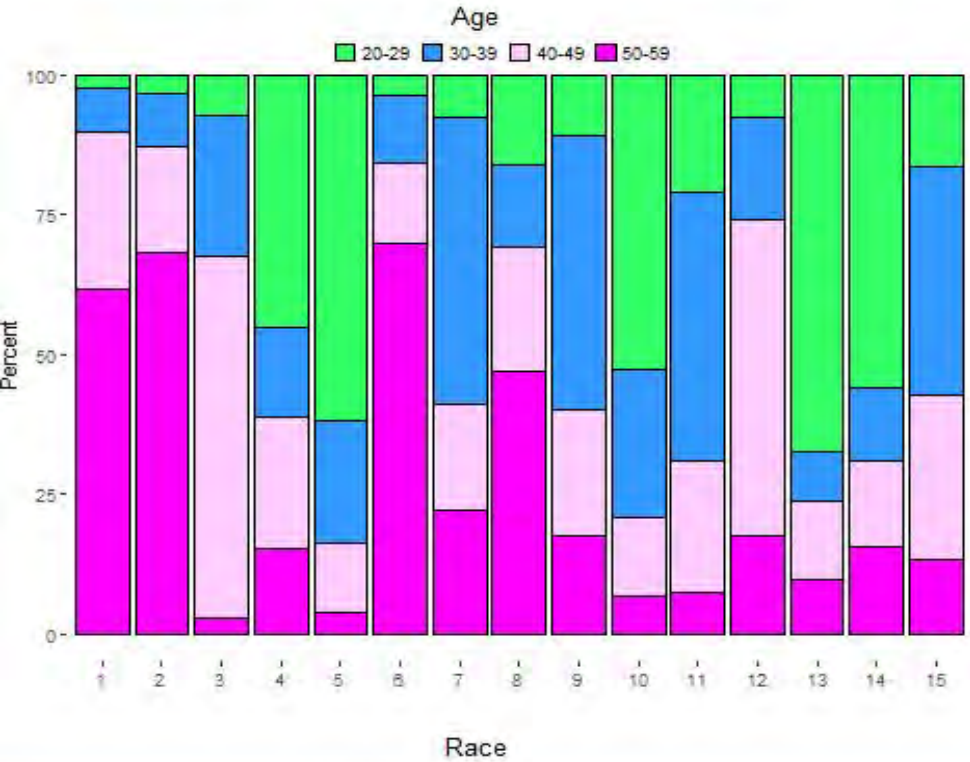

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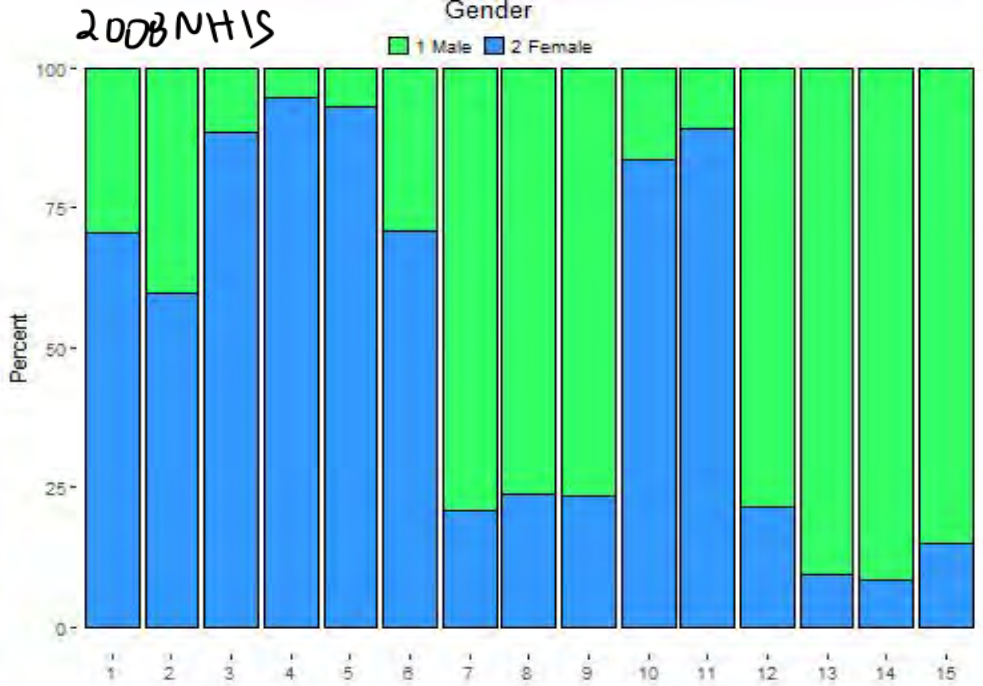

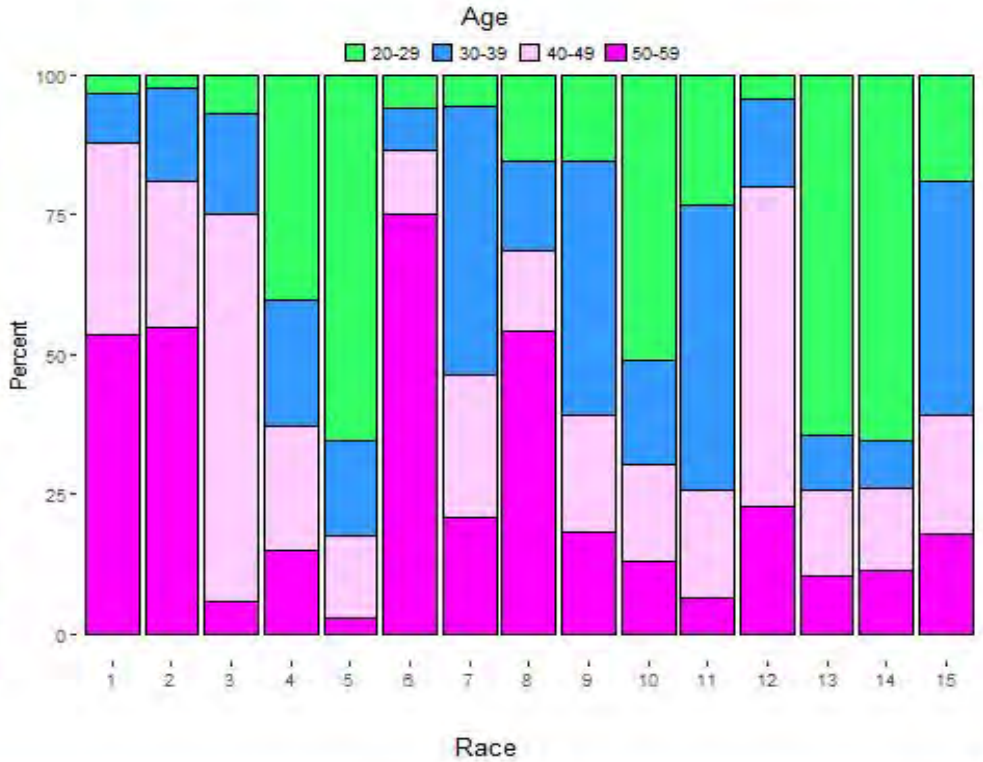

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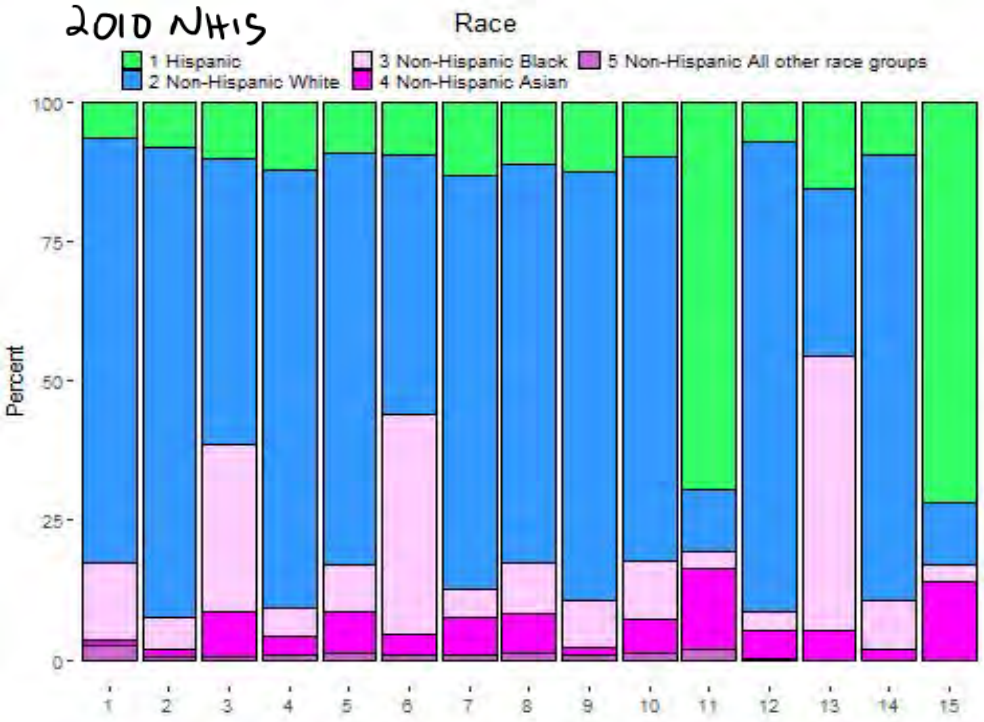

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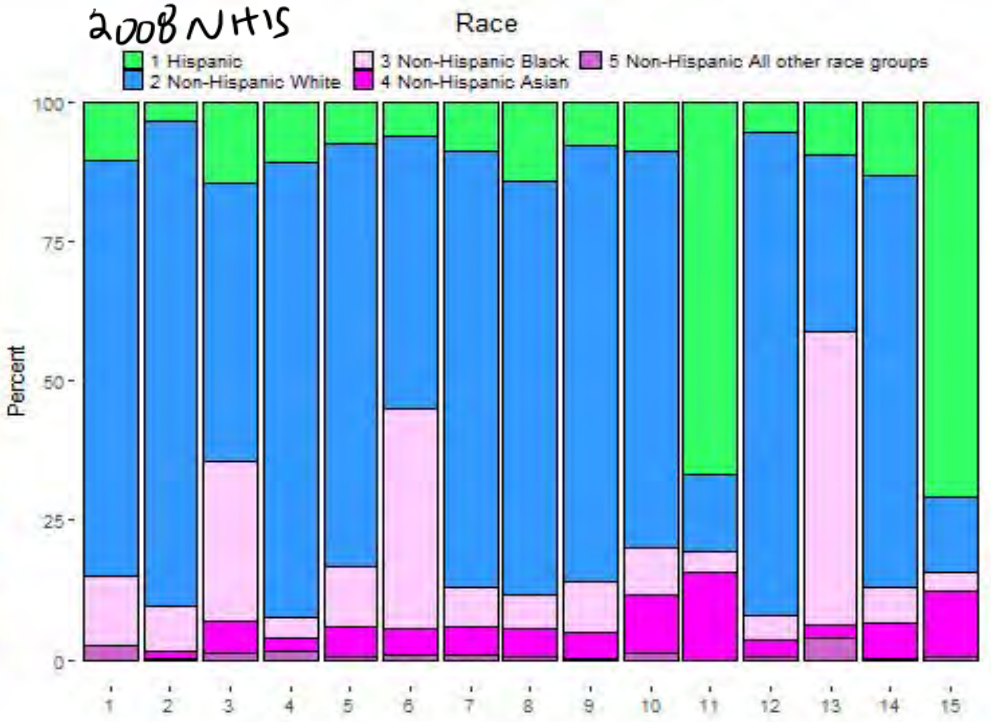

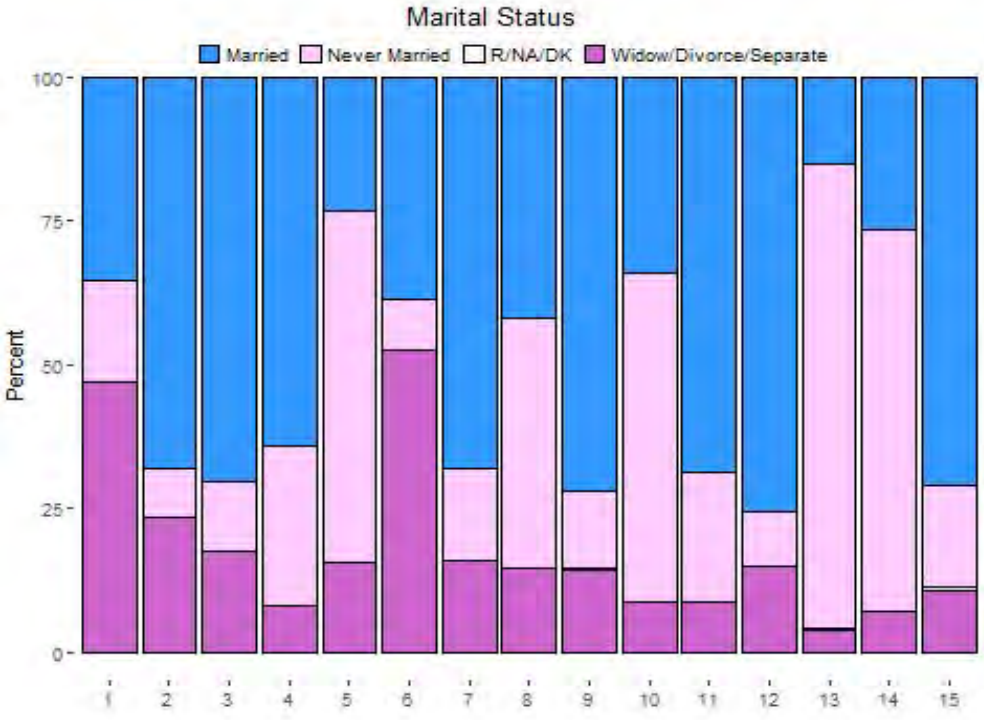

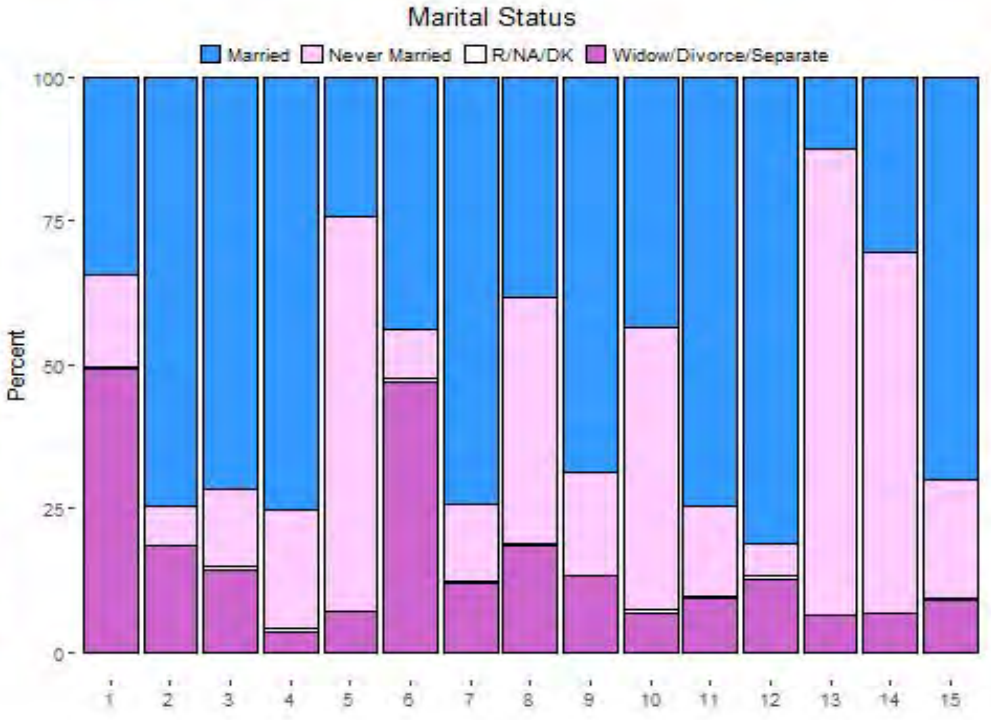

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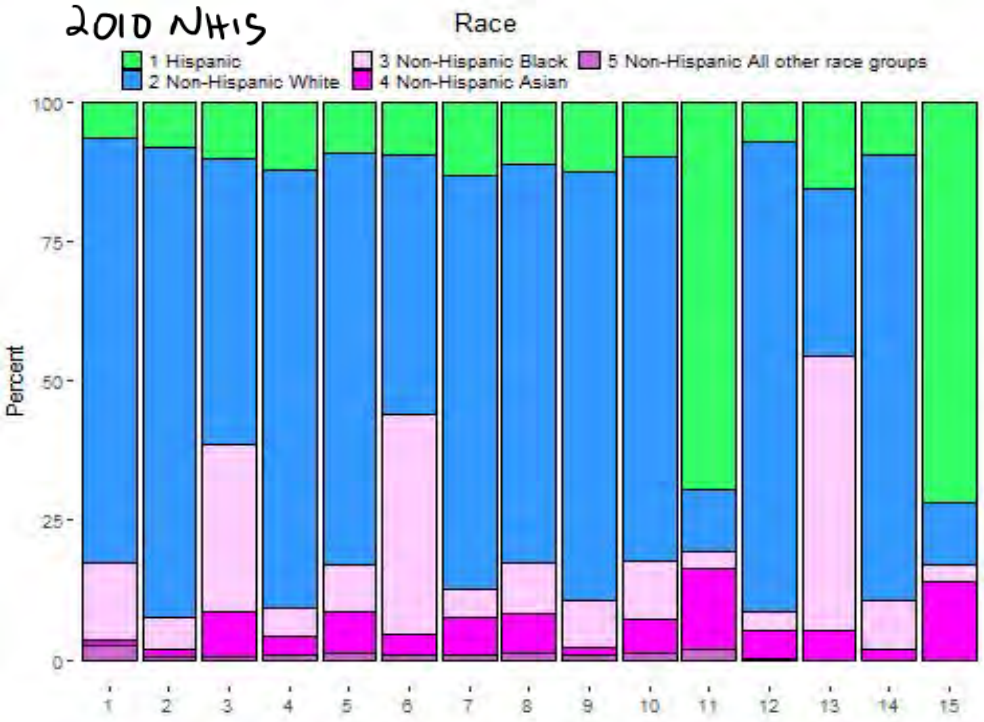

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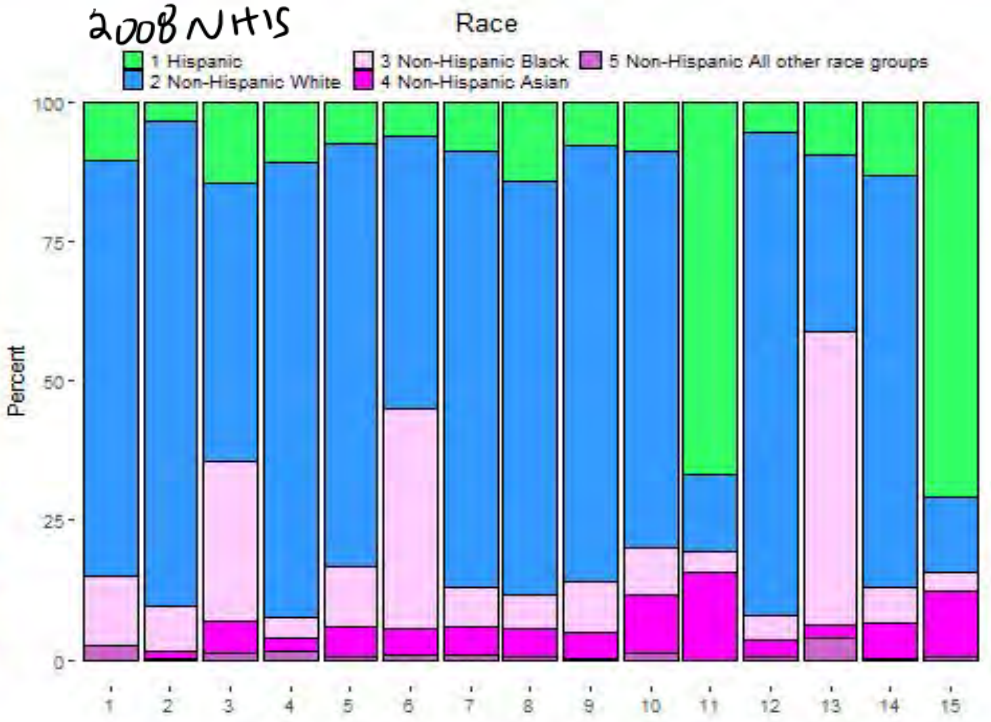

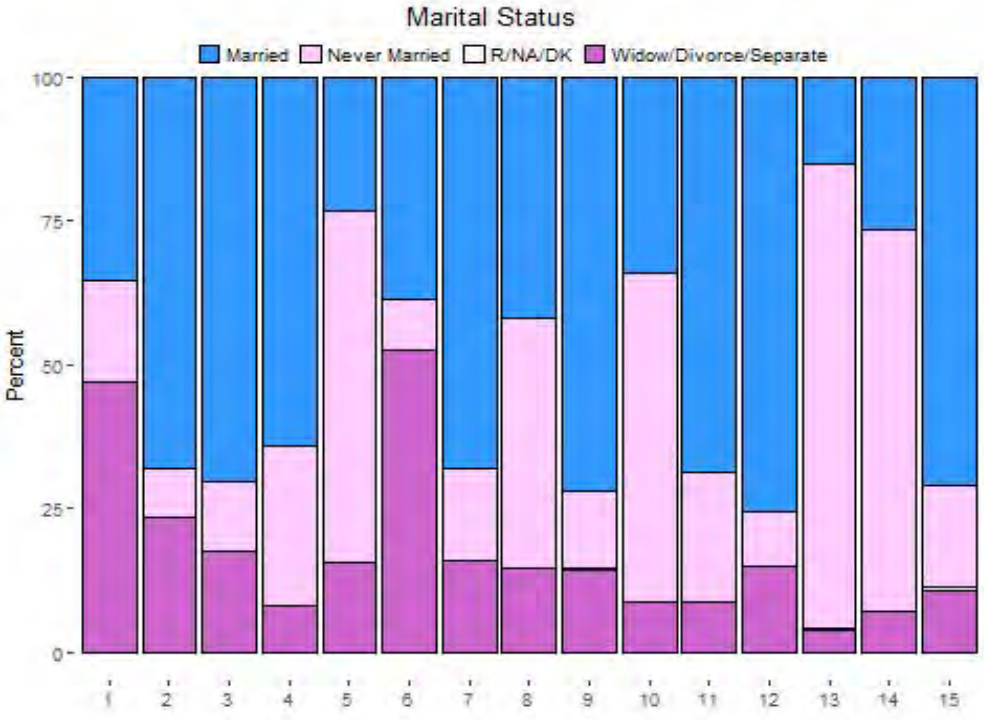

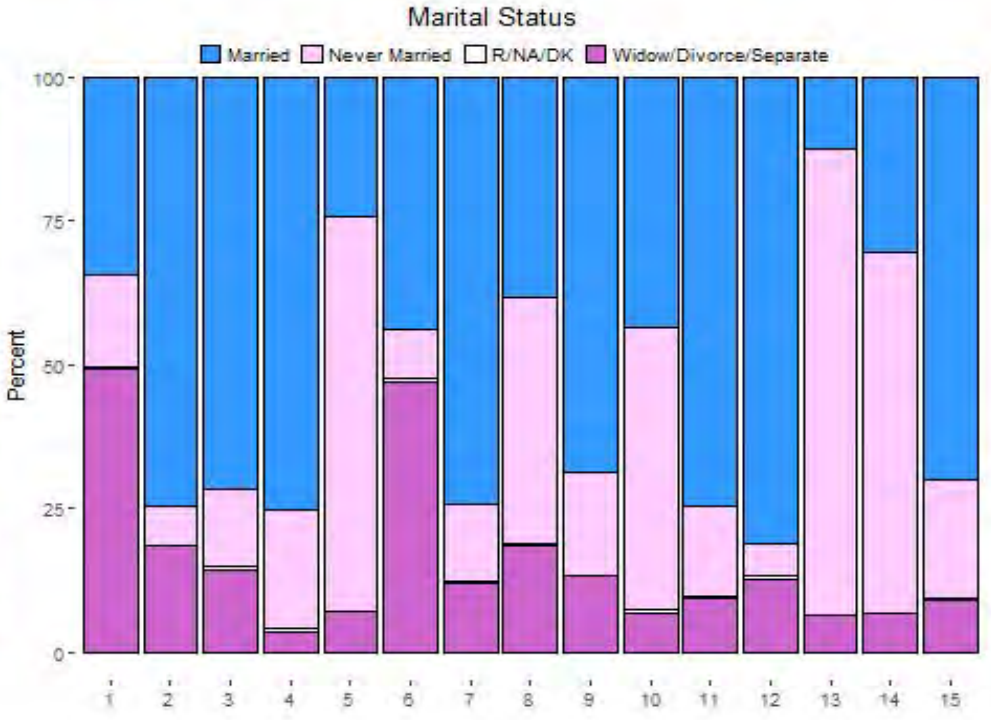

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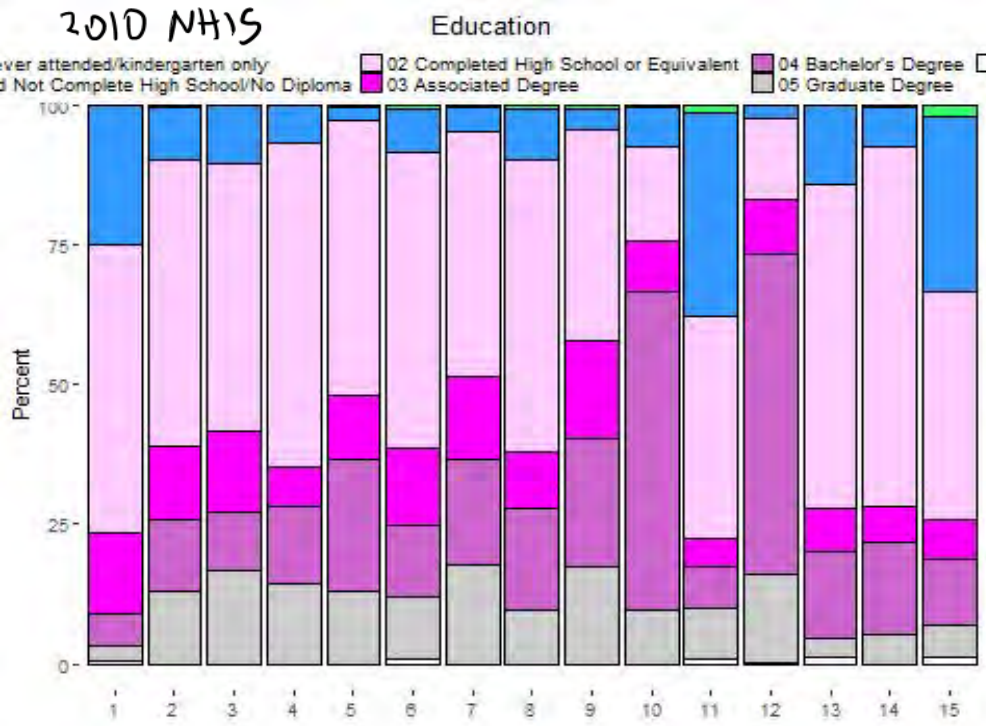

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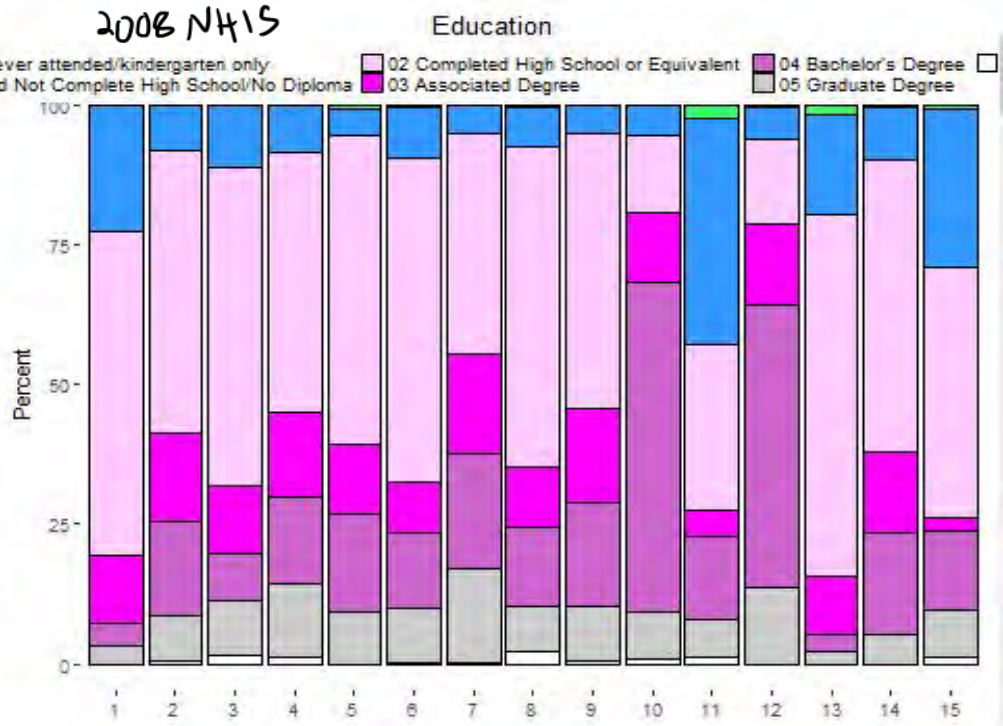

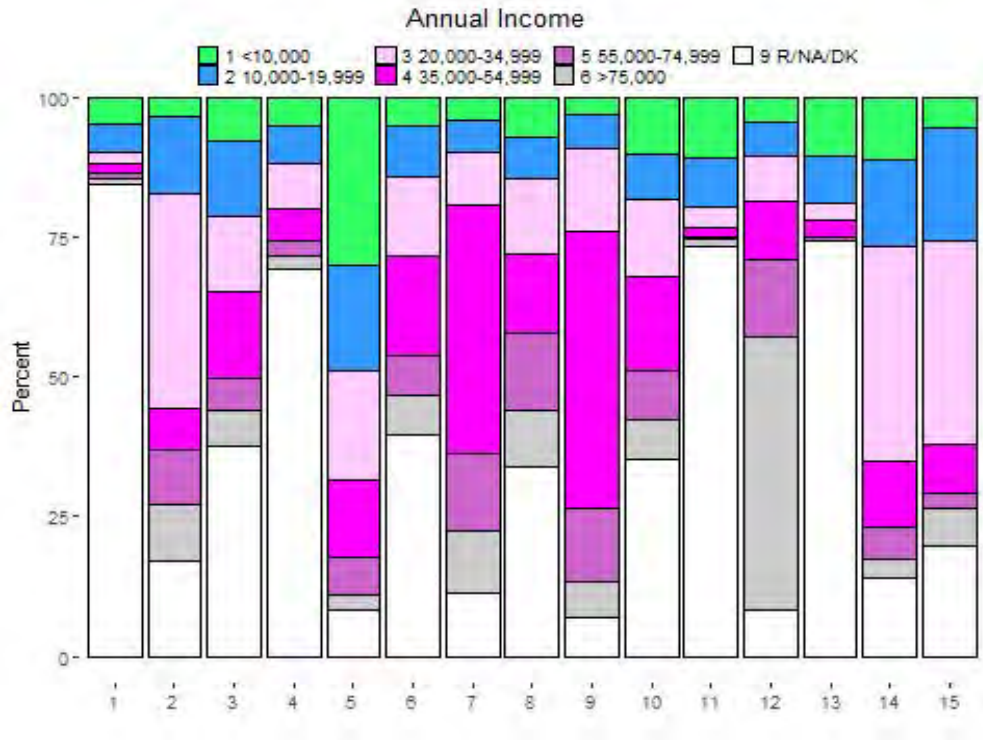

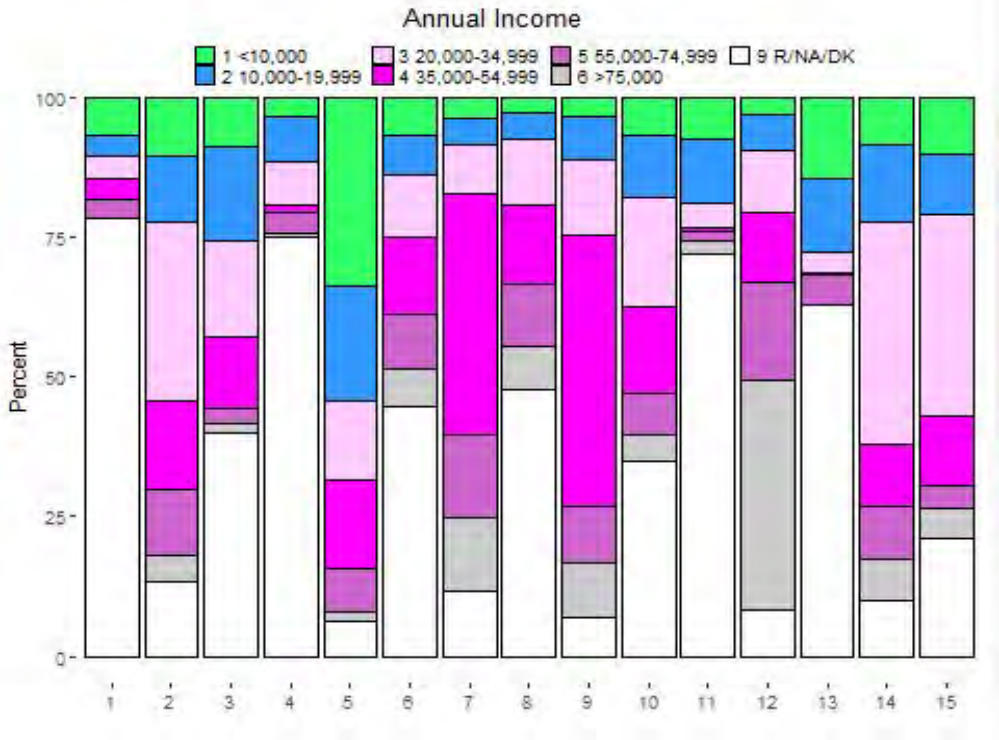

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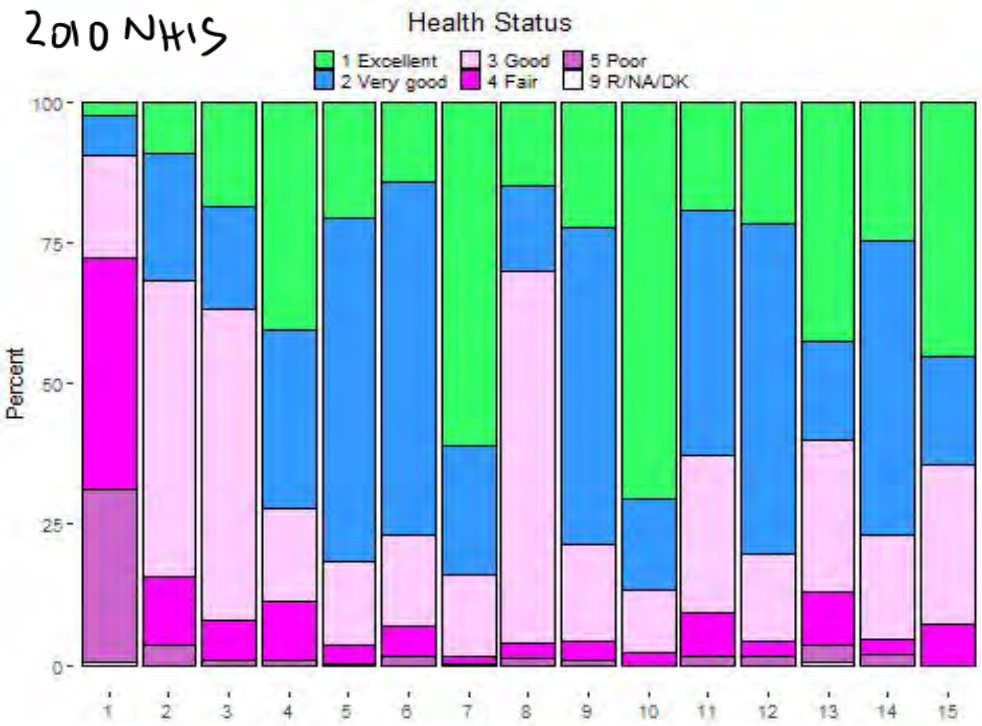

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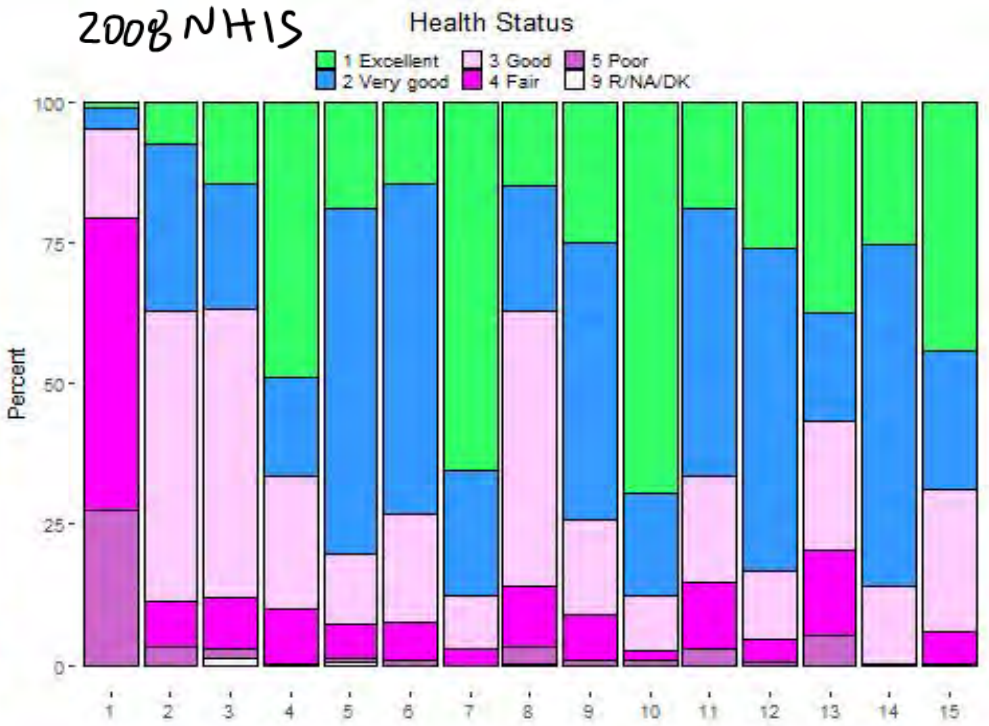
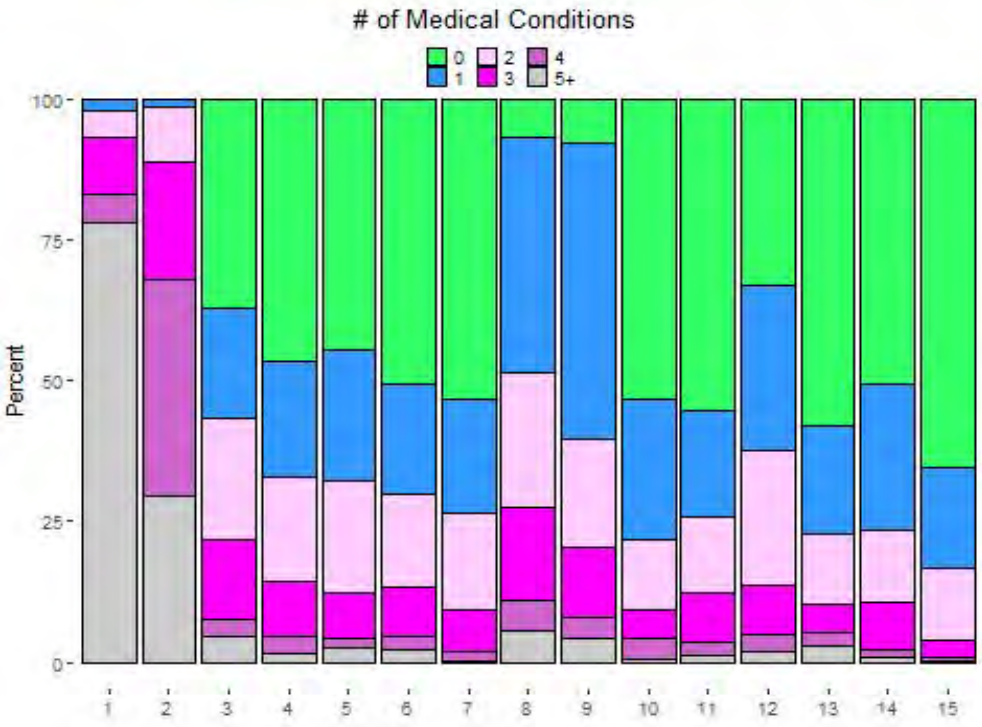
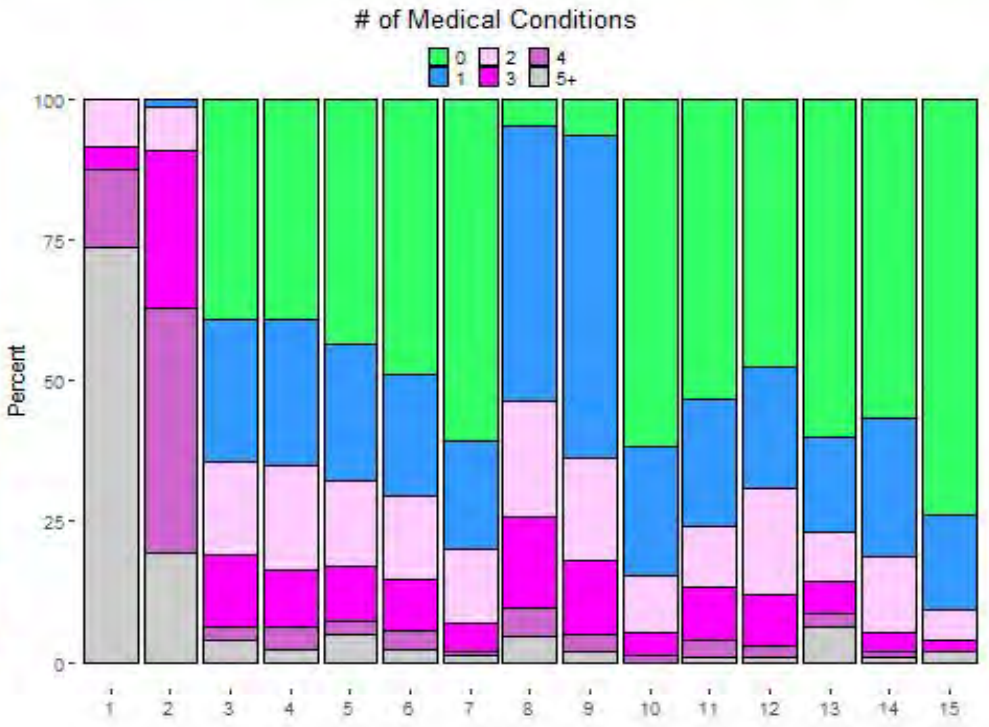
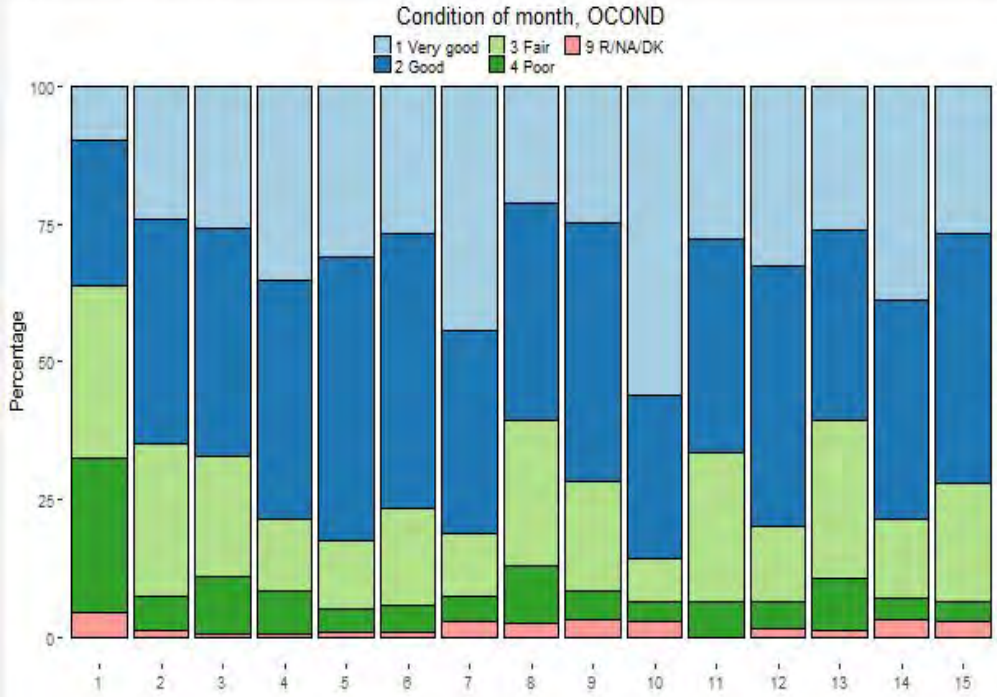
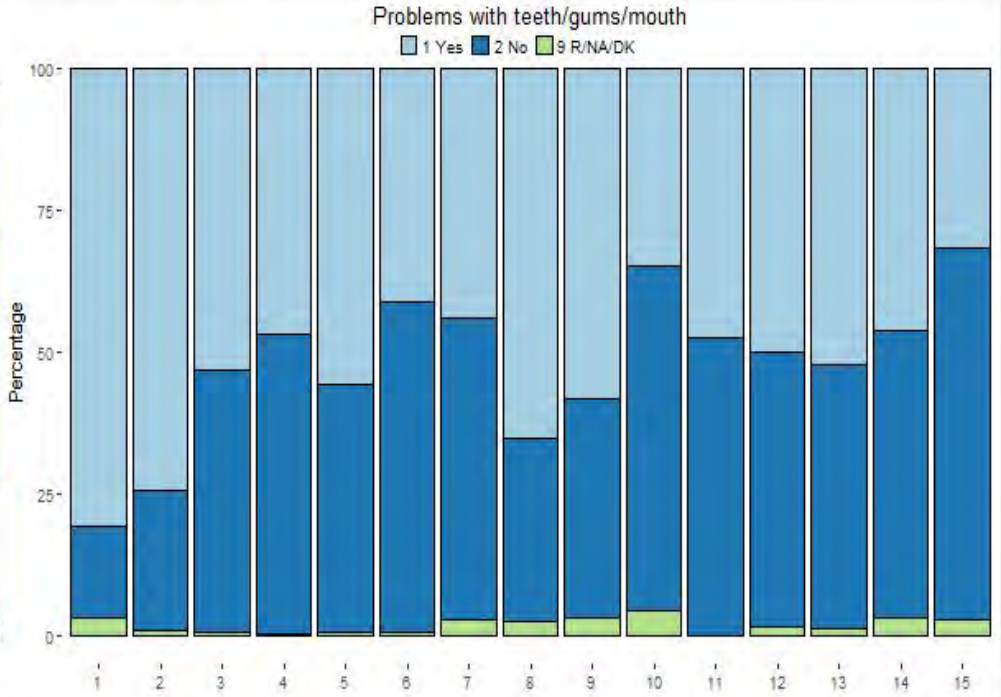


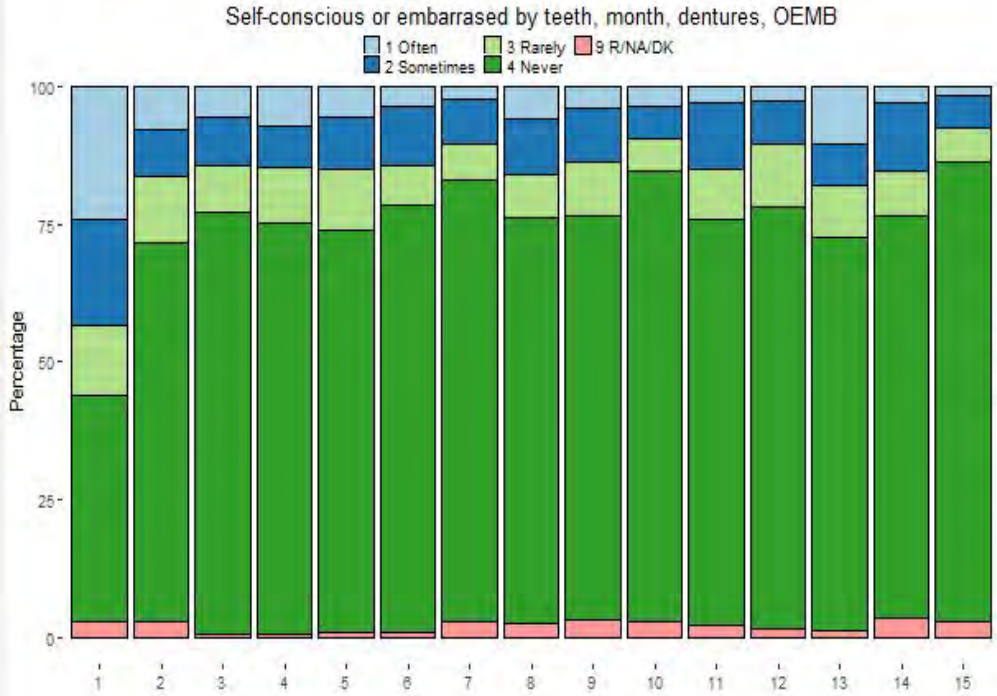


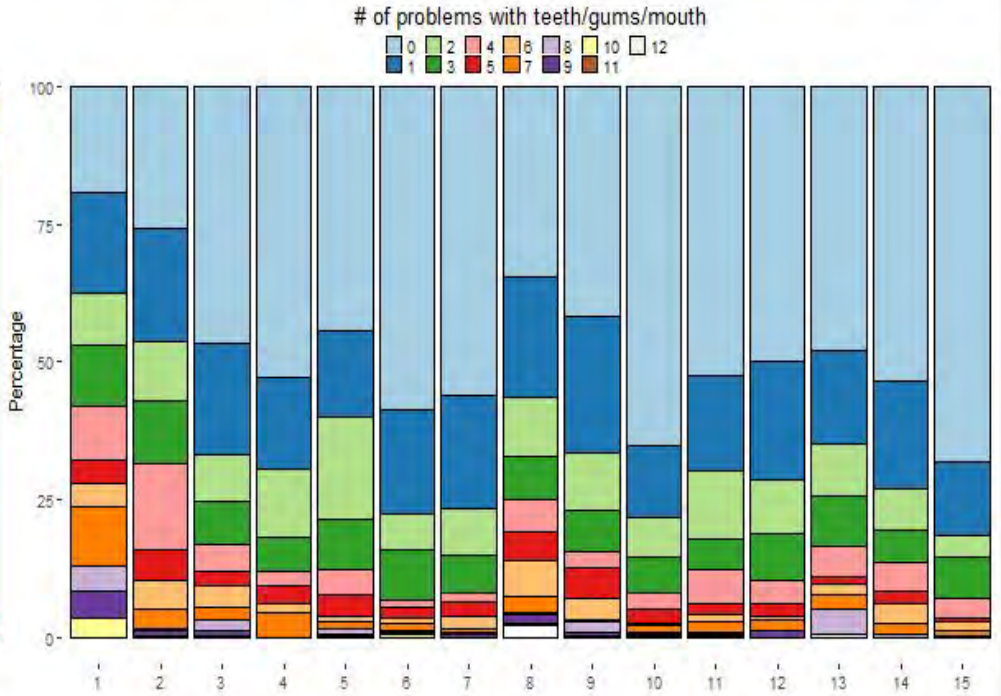


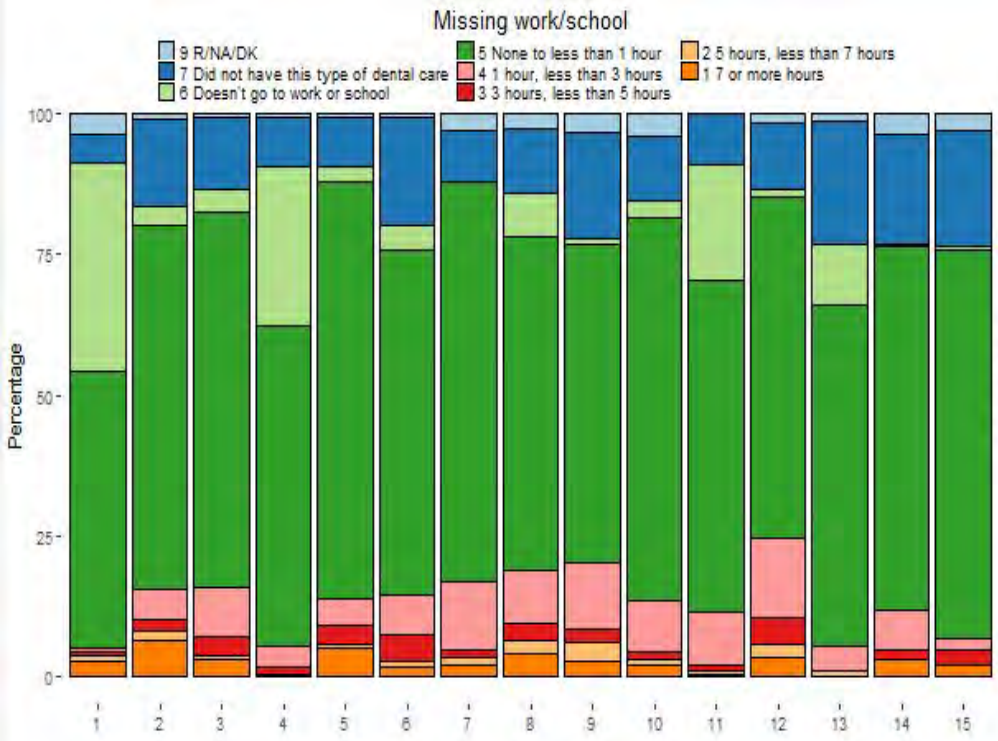
2008 NHIS dataset

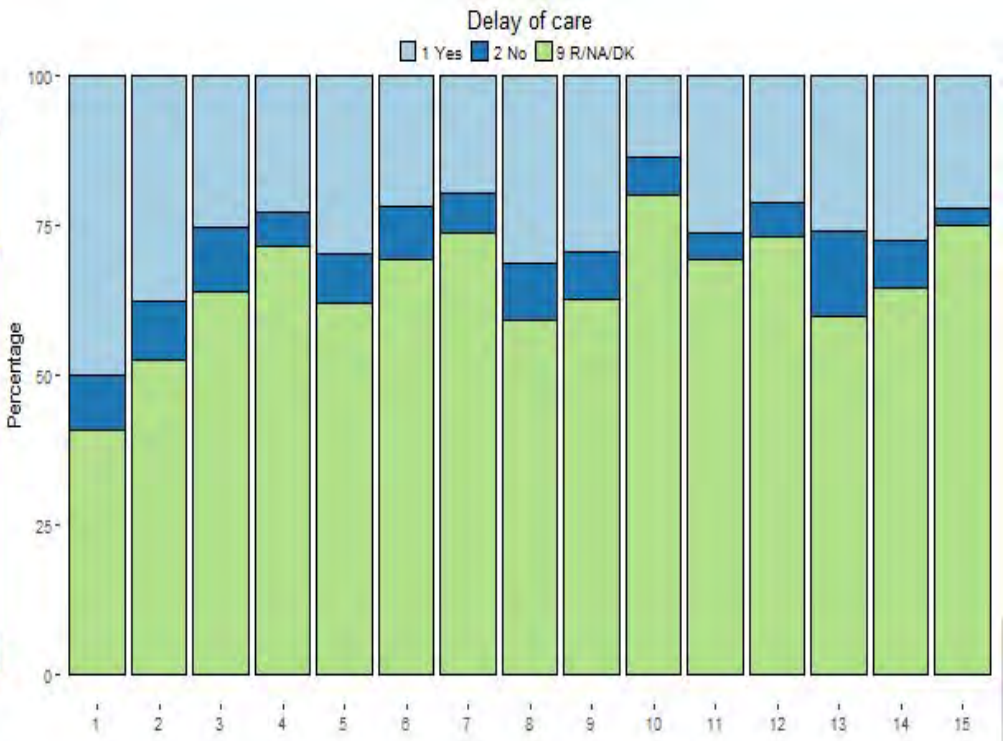


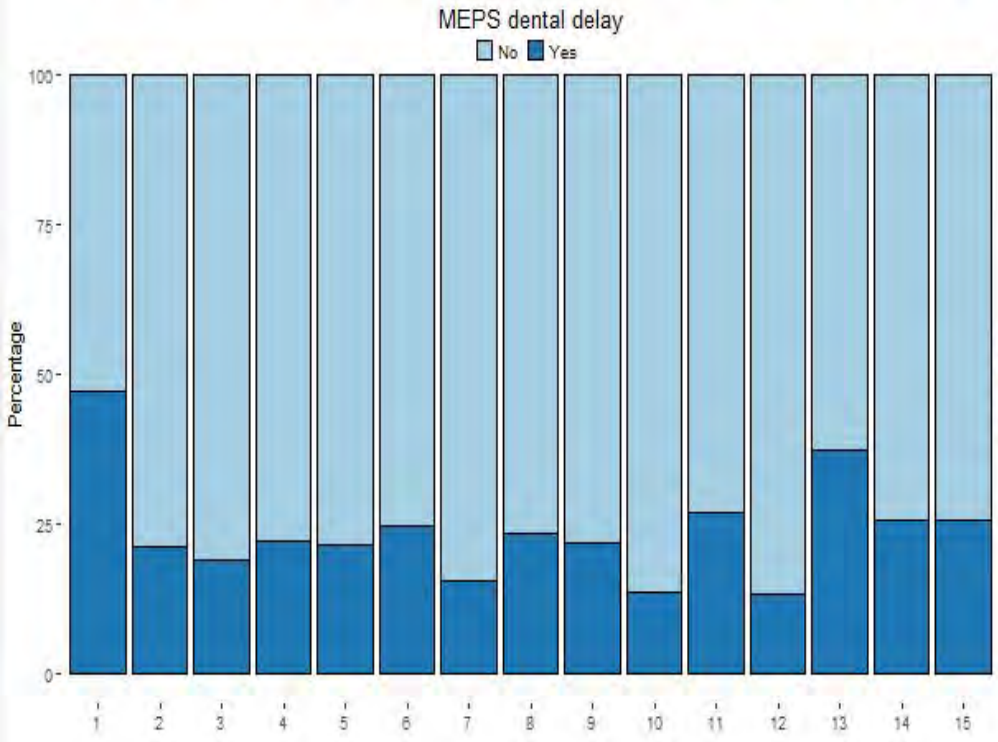


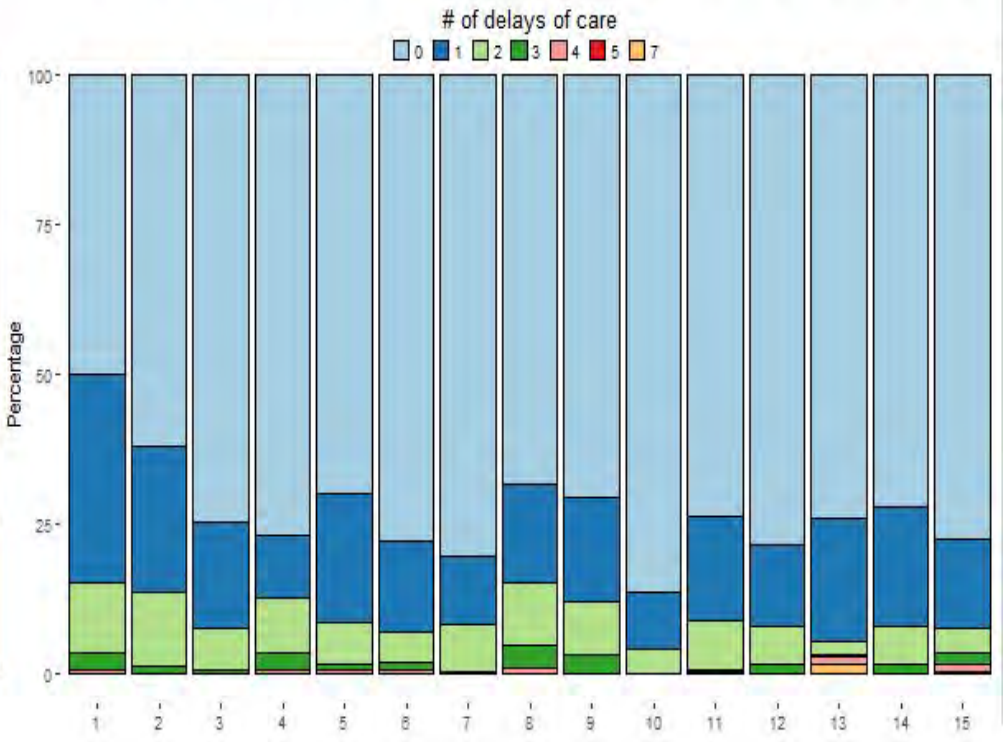





Missing work/school
9 R/NA/DK
7 Did not have this type of dental care
6 Doesn't go to work or school
5 None to less than 1 hour
4 1 hour, less than 3 hours
3 3 hours, less than 5 hours
2 5 hours, less than 7 hours
1 7 or more hours
Percentage
0
25
50
75
100
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15


Delay of care
1 Yes
2 No
9 R/NA/DK
Percentage
0
25
50
75
100
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15


MEPS dental delay
No
Yes
Percentage
0
25
50
75
100
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15


# of delays of care
0
1
2
3
4
5
7
Percentage
0
25
50
75
100
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

Take Aways

- Clusters effective in grouping individuals by social determinants
- Clusters show overlap of people in terms of *similar* characteristics
- Ordering of clusters by total expenditures *similar* across years
- Cluster differences for oral health problems

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