CHALLENGES IN STUDIES OF AGEING AND ORAL HEALTH

Prof. Dr. Jacques Vanobbergen, 9th of June 2017
• Introduction - focus
• Burden of caries and periodontal disease over lifetime
• Assess the evidence for age-adequate effective strategies to prevent and treat caries and periodontal disease.
- Introduction - focus
- Burden of caries and periodontal disease over lifetime
- Assess the extent and nature of inadequate effective strategies to prevent and treat caries and periodontal disease.

What do we have?
What are the methodological challenges?
What do we need?
• What do we have?
• What are the methodological challenges?
• What do we need?

Some:
• Discussion section of reports
• Published in the last 10 years

• Priorities for further research and limitations of reported studies
• Searching until saturation
INTRODUCTION

• Focus:
  • Challenges in studies of ageing related to oral public health
INTRODUCTION

• Focus:
  - Challenges in studies of ageing related to oral public health

Demographic changes drive the need to learn more about the burden of oral diseases (in particular caries and periodontal diseases) in older populations. More research is needed to provide the foundation for better prevention and management of these diseases in older populations.

• Introduction - focus
• Burden of caries and periodontal disease over lifetime
• Assess the evidence for age-adequate effective strategies to prevent and treat caries and periodontal disease.
• Damage due to both periodontitis and caries is largely irreversible and therefore cumulative over the lifetime

• with age the exposure to risk factors for both periodontitis and caries changes

  disease experience is certainly increasing with age, but not necessarily due to age

BURDEN OF CARIES OVER LIFETIME

BURDEN OF CARIES OVER LIFETIME

Based on 28 teeth Europe
Random sample care dependent persons

WHO 65+
Americas

BURDEN OF CARIES OVER LIFETIME


1275 nursing home residents Belgium
**BURDEN OF PERIODONTITIS OVER LIFETIME**

Prevalence of Respective Periodontitis Categories by CDC/AAP and EFP Case Definitions Among Adults Aged ≥30 Years by Selected Characteristics: NHANES 2009 to 2012

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n</th>
<th>Weighted n (millions)*</th>
<th>Periodontitis (CDC/AAP Case Definitions&lt;sup&gt;19&lt;/sup&gt;)</th>
<th>Periodontitis (EFP Case Definitions&lt;sup&gt;21&lt;/sup&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Severe, %</td>
<td>SE</td>
</tr>
<tr>
<td>NHANES 2009 to 2012</td>
<td>7,066</td>
<td>141.0</td>
<td>8.9</td>
<td>0.6</td>
</tr>
<tr>
<td>NHANES III protocol†</td>
<td>7,043</td>
<td>140.7</td>
<td>1.6</td>
<td>0.2</td>
</tr>
<tr>
<td>NHANES 2000 to 2004 protocol†</td>
<td>7,044</td>
<td>140.7</td>
<td>3.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Age (mean: 24 teeth)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 to 34 years</td>
<td>846</td>
<td>17.2</td>
<td>2.2</td>
<td>0.5</td>
</tr>
<tr>
<td>35 to 49 years</td>
<td>2,495</td>
<td>54.0</td>
<td>7.5</td>
<td>0.8</td>
</tr>
<tr>
<td>50 to 64 years</td>
<td>2,214</td>
<td>45.9</td>
<td>11.9</td>
<td>1.0</td>
</tr>
<tr>
<td>≥65 years</td>
<td>1,511</td>
<td>23.8</td>
<td>11.0</td>
<td>1.4</td>
</tr>
</tbody>
</table>

8.9% (12% EFP) of adults (30-80 years) had severe periodontitis during 2011 to 2012

More prevalent among adults age ≥ 50 years

BURDEN OF PERIODONTITIS OVER LIFETIME

Mean percentages of maximal CPI scores in 65 to 74 year olds by EURO countries

Burden of Caries and Periodontal Disease Over Lifetime

- Introduction - focus
- Burden of caries and periodontal disease over lifetime
- Assess the evidence for age-adequate effective strategies to prevent and treat caries and periodontal disease.

- What are the methodological challenges?
• Selection bias
  • Low response rates
  • Exclusion of subjects
  • Drop outs
  • Survivor effect
• Information bias
  • Examiner reliability
  • Validity: Standardisation and comparability
  • Difficulties in doing examination
• Selection bias
  • Low response rates (informed consent)
  • Exclusion of subjects

• Difficulties in obtaining informed consent
• Exclusion of subjects with cognitive impairment
• Not sampling institutionalised persons

• Selection bias
  • Drop outs

• More pronounced in elderly population groups because of worsening health or death.
• High dropout (70 years –> 85 years) because of mortality or morbidity
• 17% to 43% of baseline subjects were deceased at one year follow up.

Selection bias
Drop outs

In most cases there is no information about non-responding care-homes and residents
Difficulties in responder-non-responder analyses
Replaced by healthier counterparts

BURDEN OF CARIES AND PERIODONTITIS OVER LIFETIME

- Selection bias
  - Survivor effect

- Premature death because of poor oral health: survivors are the sample
- Healthy elderly people probably overrepresented in surveys
- Remaining teeth are ‘survivors’ without fillings, carious lesions or periodontal disease.
- ‘Biological elite’ remains

BURDEN OF CARIES AND PERIODONTITIS OVER LIFETIME

- Information bias
  - Examiner reliability
- Lack of calibration, sometimes because of frailty of the patients
- Use of own dentist (trust and more informed consent)
- Intra-examiner agreement was not recorded due to high age and length of examination

- Gerritsen, P.F.M., Cune, M.S., Van Der Bilt, A., and De Putter, C. Dental treatment needs in Dutch nursing homes offering integrated dental care. Special Care in Dentistry (2011) 31, 95–101
BURDEN OF CARIES AND PERIODONTITIS OVER LIFETIME

- Information bias
- Validity and comparability: Standardisation

- Validity in one age group does not always mean validity in another age group
- Internal validity versus external validity
- Comparability of indices (CDC/AAP ~ EFP)
- DMFT not be the best indicator of dental caries among the elderly
- Use of different periodontal probes.

Information bias
• Difficulties in doing examination

Examinations were largely done at (nursing) home, risk of underestimation of pathology (caries – periodontal disease) – position, lighting,..
Large amounts of debris en plaque hindered examination, time spent removing debris diminished the residents’ cooperative time.
Extreme difficulty of examining the frail and medically compromised. – resistant behavior

Editorial

**Aging successfully needs lifelong prevention strategies**

Monitoring waist circumference (or now using metabolites like α-hydroxybutyrate, oleic acid, linoleyl-glycerophospho-insulin (Quanto 1R) to detect early insulin resistance) early intervention appears also to be promising [7]. Early prevention and treatment of osteoporosis represents an important area to reduce hip fracture [8].

As we move to the “third age” there are numerous, either primary, secondary or tertiary prevention can be applied in the area of primary prevention regular exercise (e.g., resistance exercise), a Mediterranean-type diet, social participation and cognitive stimulation are a few examples.

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**Keywords:**
Aging successfully
Prevention
Frailty
Disability
Longevity

The underlying evidence for prevention (primary and secondary) and treatment of caries and periodontal disease, irrespective of age but focussing on age-dependent differences in efficacy.
Introduction - focus
Burden of caries and periodontal disease over lifetime
Assess the evidence for age-adequate effective strategies to prevent and treat caries and periodontal disease.
**PREVENTION**

**Periodontal disease**

- Patient-performed control of the biofilm
- Professional mechanical plaque removal (PMPR)
- Supportive periodontal treatment (SPT)
- Chemical control of the dental biofilm
- Active periodontal treatment (APT)
- Control/management of risk factors for periodontitis such as smoking and diabetes.

• Patient adherence to both effective self-performed plaque removal (or assisted in the dependent individual) and recall attendance during supportive periodontal therapy are key elements for success.

• The teeth in the Regular Compliance group had significantly less risk of being lost during SPT than did the teeth in the Erratic Compliance group. (pooled RRTL: 0.56 [CI: 0.38, 0.82], P < 0.01)

Prevention is Simpler, Easier and Cheaper than Cure

Conclusions: OH - PMPR

- There is little value in providing PMPR without Oral Hygiene Instructions to reduce gingivitis.
- Repeated and individually tailored OHI is the key element in achieving gingival health.
  
  Strength of recommendation: High, level of evidence 1.

PMPR both supra-gingivally and sub-marginally as deep as necessary to remove all soft and hard deposits is required to allow good self-performed oral hygiene.

  Strength of recommendation: Good Practice point.

- PMPR as the sole treatment modality is inappropriate in patients with periodontitis.

  Strength of recommendation: Good Practice point.

PREVENTION

• Introduction - focus
• Burden of caries and periodontal disease over lifetime
• Assess the evidence for age-adequate effective strategies to prevent and periodontal disease.

What are the methodological challenges?
PREVENTION

• Selection bias
  • Dropout is always a concern!
  • Exclusion of subjects (frail elderly – dementia)
• Very few studies
  • More inclusive regarding the quality criteria
  • Precision of the estimate (95% CI)
• Comparability
  • study designs
  • Age groups


PREVENTION

- Information bias
  - Calibration of the examiners
  - Blinding
    - Examiner blinding
    - Patient blinding
  - Assessment of the compliance
- Difficulties to include all confounders
  - E.g. motivation of patient / clinician who provides OHI


Despite the limitations there is consistency
Periodontal disease

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- Professional mechanical plaque removal (PMPR)
- Supportive periodontal treatment (SPT)
- Chemical control of the dental biofilm
- Active periodontal treatment (APT)
- Control/management of risk factors for periodontitis such as smoking and diabetes.
Altogether, the data show that when daily oral hygiene cannot be performed, CHX MW (0,2%) is the first product of choice.

A meta-analysis of the effect on 'de novo' plaque formation of CHX DF/gel versus CHX MW resulted in a difference in means of 0.27 [95% CI: 0.14; 0.39] (P < 0.0001).

Supranoto S, Slot D and Van der Weijden G. The effect of chlorhexidine dentifrice or gel versus chlorhexidine mouthwash on plaque, gingivitis, bleeding and tooth discoloration: a systematic review. Int J Dent Hygiene 13, 2015; 83–92..
INTRODUCTION - FOCUS

- Burden of caries and periodontal disease over lifetime
- Assess the evidence for age-adequate effective strategies to prevent and periodontal disease.

PREVENTION – CHEMICAL CONTROL OF THE BIOFILM

- What are the methodological challenges?
Selection bias
- Wide spread of age groups
- Only three studies could be included
Information bias
- Low to moderate risk of bias
- Patient blinding not feasible
- Assessment of compliance?

Supranoto S, Slot D and Van der Weijden G. The effect of chlorhexidine dentifrice or gel versus chlorhexidine mouthwash on plaque, gingivitis, bleeding and tooth coloration: a systematic review. Int J Dent Hygiene 13, 2015; 83–92.
PREVENTION

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PREVENTION

• Introduction - focus
• Burden of caries and periodontal disease over lifetime
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• What do we have?
PREVENTION

Caries

• Caries management (continuum of preventive and treatment strategies)
  • Primary prevention: caries onset prevention
  • Secondary prevention: caries lesions

What about:
• Older and dependent patients?
• Root caries?

Rich history of RCT’s and Cochrane Reviews involving adolescents and younger children

Common aetiology for coronal and root caries

More vulnerable to demineralisation

More efficacious preventive and therapeutic treatments are needed

Fig. 1. Ecological caries hypothesis illustrating the mechanism responsible for the development of dentin and root caries based on the extended ecological caries hypothesis proposed by Takahashi and Nyvad [2008] (for detailed description, see text).
PREVENTION

Caries

- Caries management (continuum of preventive and treatment strategies)
  - Primary prevention:
    - oral hygiene: daily brushing with FD
    - Fluoride-based therapy
  - Secondary prevention: non-operative approach

There is robust evidence suggesting that fluoride-based therapies are efficacious. Evidence from younger patient cohorts in relation to coronal caries is mirrored by evidence examining fluoride use in root caries in older adults.

PREVENTION

Caries

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There is robust evidence suggesting that fluoride-based therapies are efficacious. Evidence from younger patient cohorts in relation to coronal caries is mirrored by evidence examining fluoride use in root caries in older adults.

Griffin SO, Regnier E, Griffin PM, Huntley V. Effectiveness of fluoride in preventing caries in adults. SR J Dent Res. 2007 May;86(5):410-5
Fluoride mouthrinse
NaF 0.05% (225 ppm) - 0.2%(1000 ppm)
(Europe) SnF and Amine F

<table>
<thead>
<tr>
<th>First author [year]</th>
<th>Design</th>
<th>Number; duration</th>
<th>Age, years</th>
<th>Intervention; frequency; concentration</th>
<th>Control</th>
<th>Preventive fraction</th>
<th>Risk of bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root caries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wyatt [2004]</td>
<td>RCT</td>
<td>247; 2 years</td>
<td>83 (mean)</td>
<td>FMR; 1/day; 0.09% NaF</td>
<td>placebo</td>
<td>24%</td>
<td>high</td>
</tr>
<tr>
<td>Petersson [2007]</td>
<td>RCT</td>
<td>100; 1 year</td>
<td>55–81</td>
<td>FMR; 2/day; 250 ppm AmF</td>
<td>placebo</td>
<td>57%</td>
<td>high</td>
</tr>
</tbody>
</table>

PF = Preventive fraction; SB = school-based; FMR = fluoride mouth rinse; CCT = controlled clinical trial.

a Proximal surfaces from bitewing radiographs. b Odds for a tooth being decayed (95% CI 0.65–0.96). c Risk of developing caries (95% CI 0.26–0.85). d Most pronounced in reversing and preventing root surfaces. e Root caries reversals.
PREVENTION

Caries

• Caries management (continuum of preventive and treatment strategies)
  • Primary prevention:
    • oral hygiene: daily brushing with FD
    • Fluoride-based therapy
  • Secondary prevention: non-operative approach

boosting fluoride concentrations for improved control of root caries in a non-operative approach
PREVENTION

Caries

Fluoride varnish
5% NaF (22,600 ppm)

<table>
<thead>
<tr>
<th>Study (yr) (ref)</th>
<th>Caries risk status</th>
<th>Experimental group (n)</th>
<th>Comparative group (n)</th>
<th>Duration</th>
<th>Outcome (exp versus control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ekstrand et al. (2008) (20)</td>
<td>Population risk: nursing referral of frail elderly; mean # of RC lesions = 2.09</td>
<td>5% NaF varnish (22,600 ppm) 1×/mo, applied to active carious lesions by hygienist after brushing with NaF toothpaste (1,450 ppm) 1×/mo</td>
<td>OTC NaF toothpaste (1,450 ppm) 2×/day (54)</td>
<td>8 months</td>
<td>RC remineralization/subject 65% versus 40% (P &lt; 0.001, ANOVA)</td>
</tr>
</tbody>
</table>

Fluoride DF/gel
1.1% NaF paste (5,000 ppm)

<table>
<thead>
<tr>
<th>Study (yr) (ref)</th>
<th>Caries risk status</th>
<th>Experimental group (n)</th>
<th>Comparative group (n)</th>
<th>Duration</th>
<th>Outcome (exp versus control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ekstrand et al.  (2008) (20)</td>
<td>Population risk: nursing referral of frail elderly; mean # root caries lesions = 2.09 Water F: 0.5 ppm</td>
<td>1.1% NaF paste (5,000 ppm) 2×/day (64)</td>
<td>OTC NaF toothpaste (1,450 ppm) 2×/day (54)</td>
<td>8 months</td>
<td>RC remineralization/subject 54% versus 40% (P = 0.02, ANOVA)</td>
</tr>
</tbody>
</table>

Elderly disabled nursing home residents who had their teeth brushed by the nursing staff twice a day

**Intervention:** 5000 ppm

**Control:** 1450 ppm

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**Table 4. Changes between baseline and follow-up examination in the two groups**

<table>
<thead>
<tr>
<th></th>
<th>Number of participants</th>
<th>Number of lesions</th>
<th>Mean number of lesions</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active at baseline and arrested at follow-up (p &lt; 0.00001)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention group</td>
<td>61</td>
<td>105</td>
<td>1.72</td>
<td>1.17</td>
</tr>
<tr>
<td>Control group</td>
<td>64</td>
<td>18</td>
<td>0.28</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Caries

Fluoride DF/gel
1.1% NaF paste (5,000 ppm) - risk ratio for not reversing

PREVENTION

Silver Diamine Fluoride (SDF) 28%

| Table 3. Relative Risk of Developing New Root Caries and the Number of Elders Needed to Treat (NNT), with 95% Confidence Interval (CI) Given in Parentheses |
|---|---|
| Relative Risk (95%CI) | NNT (95%CI) |
| OHI + chlorhexidine vs. OHI | 0.27 (0.11–0.66) | 3.2 (2.1–8.3) |
| OHI + sodium fluoride vs. OHI | 0.26 (0.10–0.63) | 3.1 (2.1–7.7) |
| OHI + SDF vs. OHI | 0.19 (0.07–0.46) | 2.5 (1.8–4.8) |

No intervention was significantly superior to the other


Caries

CHX varnish 1% 3-monthly
NaF varnish 5% 3-monthly
38% SDF yearly
**Conclusion**

Within the limitations of this review, it may be concluded that in the absence of regular professional tooth cleaning and oral hygiene instructions, CHX-V may provide a beneficial effect for patients in need of special care. The strength of this recommendation is graded as ‘weak’.

Caries

Conclusion

• Root caries lesion development can be controlled at the population level by brushing the teeth twice a day with conventional fluoride toothpaste (1000-1500 ppm F).
• Active root caries lesions can be converted into inactive lesions by twice daily brushing with conventional fluoride toothpaste (1000-1500 ppm F), combined with professional applications of 5% NaF varnish or 2% NaF solution 3-4 times a year.
• Alternatively, lesion arrest might be obtained by brushing lesions twice a day with high-F toothpaste (5000 ppm F).
• Fluoride interventions should be combined with meticulous dental hygiene and sugar control to optimize the caries-controlling effect.
• Daily use of a fluoridated mouth-rinse may help in controlling root caries lesion development in the elderly medically compromised patient.
• Chlorhexidine has no additional effect in combination with regular use of fluoride.

PREVENTION

• Introduction - focus
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• Assess the evidence for age-adequate effective strategies to prevent and treat caries and periodontal disease.

• What are the methodological challenges?
• Drop out (70 years -> 85 years (mortality/morbidity)
• Case definition (e.g. activity of RCL)
• Paucity and poverty of evidence
• Quantity and quality of studies on fluoride effectiveness among adults!
• Poor compliance (difficult to control and measure)
• Patient/examiner blinding is limited
• Follow-up times rather short

PREVENTION

- Drop out (70 years -> 85 years (mortality/morbidity))
- Case definition (e.g. activity of RCL)
- Paucity and poverty of evidence
- Quantity and quality of studies on fluoride effectiveness among adults!
- Poor compliance
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- Available evidence comes from systematic reviews or meta-analyses of RCTs.
- Consistency of the effect size
RECOMMENDATIONS (RANDOM ORDER)

- Assessment methods need to be converged, a gold standard for periodontal recording is necessary.
- Qualitative research methods can be appropriate to understand some complex relationships.
- Full mobile equipment will be useful.
- Using the shortest study duration reduces sample bias.

RECOMMENDATIONS (RANDOM ORDER)

• Previous studies can be useful to improve sampling strategies.
• Recently evolved, statistically sound alternatives to eliminating cases with missing data are now accepted as state of the art.
  • Full information likelihood procedure
  • Multiple imputation methods

There is an urgent need for epidemiological surveillance of caries, periodontal diseases, tooth loss and oral health-related quality of life in older populations.

FUTURE RESEARCH

What do we need?

National oral health surveys need to include representative samples of 65- to 74-year-olds and 75+ year-olds, including the very old (85 years and older) and frail and/or care dependent elders, and older people with multimorbidity and polypharmacy (e.g. by oversampling).

Reporting of surveys need to follow standardized formats in order to allow comparisons and data synthesis.

FUTURE RESEARCH

What do we need?

Epidemiological evaluations in older populations should include oral hygiene levels, tooth loss, attachment level, pocket probing depths and inflammation (bleeding on probing) as well as the presence and number of coronal and root caries lesions, their severity and activity.

Quality-of-life measures, salivary secretion rates and (medical) risk factors should also be assessed.

Priorities should be placed on how preventive and therapeutic regimens may preserve oral health, quality of life and nutrition into older age as comorbidities present unique challenge to the delivery of intrinsically efficacious and effective strategies.
FUTURE RESEARCH

What do we need?

To understand disease progression with age, future long-term longitudinal studies recording the disease extent and severity of both caries and periodontitis in these age groups, as well as a comprehensive set of preventive strategies, are warranted.

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  Ellen Palmers
Prof. Dr. Jacques Vanobbergen

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thank you for your attention