**EXTENDING THE IARC MONOGRAPHS**

- The IARC Monographs: systematic reviews that impact cancer control through hazard identification
- The IARC Monographs review process can be extended to guide cancer control by:
  - Characterizing risk and dose-response (e.g. meta-analyses)
  - Estimating disease burden (e.g. population attributable fraction)
  - Increasing knowledge dissemination to the scientific community and general public
  - This approach was recommended by an Advisory Group on Quantitative Risk Characterization in the IARC Monographs (November 2013)

**ROLE OF META-ANALYSES**

- Meta-analyses can support the hazard identification process
- Importance of Meta-analyses for Evaluating Carcinogens
  - Bladder cancer risk in painters

**APPLICATION TO CANCER CONTROL**

- Oral cancer is one of the 5 most common cancers in regions where betel quid (BQ) is chewed (Figures 1, 2)
- BQ composition varies by country (Figure 3):
  - Areca nut (necessary component)
  - With tobacco (BQ+T) → South-Central Asia
  - Without tobacco (BQ-T) → Taiwan, China; PNG
  - Other substances (e.g. spices, inflorescence)
- IARC Group 1: BQ+T, BQ-T, Areca nut
  - Oral cavity & esophageal cancer (BQ+T, BQ-T)
  - Pharyngeal cancer (BQ+T)
- In a meta-analysis of 50 studies, we showed:
  - Oral cancer risk varies by several factors including type of quid, region, sex (Table 1)
  - Dose-response varies by country (Figure 4)
  - ~50% of oral cancers in India & Taiwan, attributable to chewing BQ (Table 2, Figure 5)

**Table 1.** Select results for betel quid chewing and oral and oropharyngeal cancer, stratified by region and tobacco habit.

<table>
<thead>
<tr>
<th>Region</th>
<th>Oral cancer RR (95% CI)</th>
<th>Oropharyngeal cancer RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>2.04 (1.51 - 2.74)</td>
<td>3.53 (2.76 - 4.52)</td>
</tr>
<tr>
<td>Taiwan, China</td>
<td>1.57 (1.36 - 1.81)</td>
<td>4.86 (3.70 - 6.40)</td>
</tr>
</tbody>
</table>

**Table 2.** Population attributable fractions and oral cancer attributable to betel quid chewing, calculated from meta-analysis risks.

<table>
<thead>
<tr>
<th>Region</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>57%</td>
<td>65%</td>
</tr>
<tr>
<td>Taiwan, China</td>
<td>41%</td>
<td>52%</td>
</tr>
</tbody>
</table>

**Figures**

- Figure 1: Global distribution of oral & pharyngeal cancers
- Figure 2: Countries where BQ is chewed in part of local tradition
- Figure 3: Betel quid in India (quid)
- Figure 4: Characterizing the dose response risk of oral/pharyngeal cancer and daily use of BQ+T in India and BQ-T in Taiwan, China; Naturalistic models with 95% confidence intervals
- Figure 5: Knowledge dissemination: meta-analysis to news release