RF Personal Exposimetry on Employees of Elementary Schools, Kindergartens and Day Nurseries as a Proxy for Child Exposures
Péter JUHÁSZ
József BAKOS
György THURÓCZY

National Research Institute for Radiobiology and Radiohygiene
Budapest, Hungary
Overview
The Objective:
To assess the EMF exposure of children
Difficulties:
Hard to work with children
Parental consent/cooperation required
Increased risk to expensive PEM units
Workaround:
Exposure proxies
Measure exposure of adults who work in close proximity to children
Specifically:
Kindergarten/day nursery caretakers
School teachers
They spend part of their worktime in the same microenvironment (same room) as the children they care for.
They are expected to receive the same exposure pattern as the children (at least from base stations and DECT/Wi-Fi sources)
Methods
RF Personal Exposimetry
Exposimeters used:
Satimo EME Spy 121
Antennessa DSP 090
GSM, UMTS:
Separation of uplink (emitted by the phone) and downlink (emitted by the base station)
Measure interval: 15 or 30 s
Volunteer groups:
<table>
<thead>
<tr>
<th>Group</th>
<th>Children age</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kindergarten caretakers</td>
<td>3–6</td>
<td>50</td>
</tr>
<tr>
<td>Day nursery caretakers</td>
<td>1–3</td>
<td>50</td>
</tr>
<tr>
<td>School teachers</td>
<td>6–14</td>
<td>30</td>
</tr>
</tbody>
</table>

(n=60 in 2009 and n=20 in 2010)
Activity diary
Each entry consists of:

- Description
- Start of activity
- Activity type
- Comment
Activity types
Work
Home
Sleep
Travel
Other
Example graph
Manual evaluation of diaries
Every diary entry was carefully examined and marked 0–5 as a level of certainty that the volunteer was actually near children during that period.
5 explicitly stated as such
not explicitly stated,
but can be inferred
3 probably
2 not likely, but possibly
1 unlikely
0 unrelated activity
Manual evaluation:
tedious, involves a lot of guesswork
Simplified evaluation:
Every entry marked as Work
Further simplified evaluation:
Every data point between 8:00 – 16:00
Results
Number of acceptable data points as a function of category and grouping
Ratio of points above detection limit
Hardware limitation:
detection limit of 0.05 V/m
Points above det. limit: GSM 900 Base Station

- All
- 2009
- 2010
- Kindergarten
- School

%
Points above det. limit: WIFI

All 2009 2010 Kindergarten School

%
Descriptive statistics
Other frequencies:
Negligible exposure from TV, TETRA, UMTS
DECT: negligible,
but simplified evaluation overestimates
FM: Above-DL but low exposure
Comparison by frequencies
Category 5 datapoints only as the best quality data for estimating exposure of children
Comparison by frequencies: Only points in category 5

All volunteers

E [V/m]

Max
Upper quartile
Median
Lower quartile
Min

900 1800 UMTS 900 1800 UMTS DECT WIFI FM

Mean × 90th Percentile ▲ 95th Percentile ▼
Discussion
Quality of exposure diaries vary
Information given by volunteers
often incorrect or misleading
Data quality is problematic
Robust ROS: method to estimate unbiased mean and SD of a left-censored dataset

Attempted, with inconclusive results
(Too many points below DL)
Only a fraction of the full dataset usable for estimation of exposure of children
\( (n \approx 4800 \text{ out of } 265000) \)
To get that usable dataset, diaries have to be manually evaluated.
Simplified evaluation often under- or overestimates exposure
Recommendations
The better the diaries, the easier to work with them → Better quality data
Proper instruction of volunteers is essential