The HBM4IRE Study: Assessing Feasibility for Establishing a National Human Biomonitoring Program in Ireland

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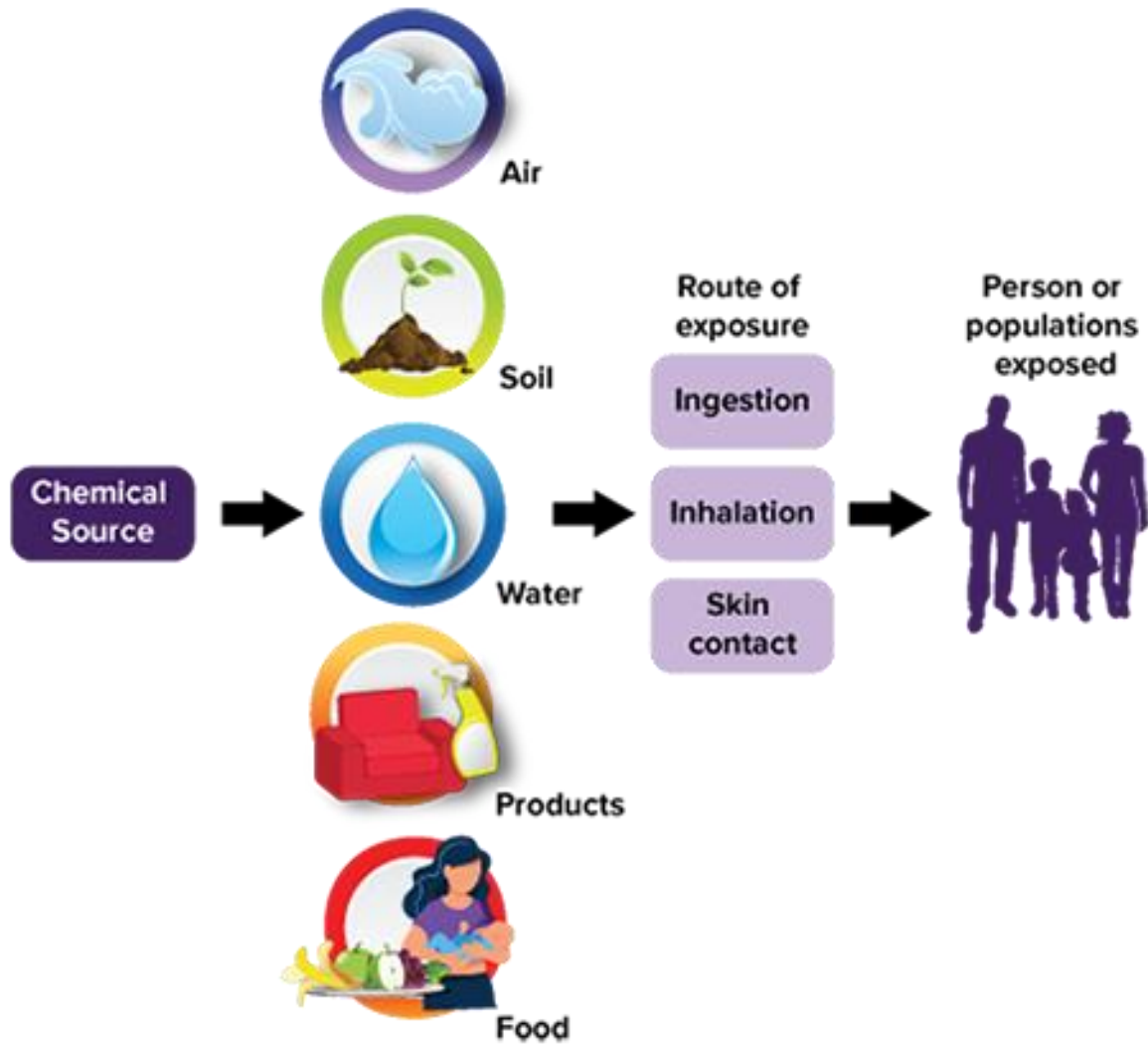# Content of Presentation

- What is HBM Programme and why we need it for Ireland?

- Overview and Objectives of the Project

- Approach to prepare the chemical priority list for Ireland

- Methodology adopted for review of the state-of-the-art in current/previous HBM programmes

- Summary and way forward

Chemical Exposure in Environment

Why Human Biomonitoring programme for Ireland ?

- A scientific method for assessing human exposure to chemicals by measuring their concentrations in biological samples (e.g., blood, urine, hair).

- Target Groups: Can focus on the general population, specific at-risk groups, or occupationally exposed individuals.

- Numerous EU countries have established robust national HBM programs, showcasing their potential to safeguard public health and the environment. ***Ireland lacks such a program***

Overview of the project

The Human Biomonitoring for Ireland (HBM4IRE) project's aim is to evaluate the criteria required to develop a national Human Biomonitoring (HBM) surveillance programme for Ireland to contribute to monitoring environmental chemical exposures.

Project Team

- **Alison Connolly ,** University College Dublin
- **Holger Koch ,** Institute for Prevention & Occupational Medicine, Germany
- **Marike Kolossa-Gehring ,** German Environment Agency, Germany
- **Andre Conrad,** German Environment Agency
- **Marie Coggins,** University of Galway
- **Conor Buggy,** University College Dublin
- **Richa Singh,** University College Dublin

Objectives

Undertaking a Comprehensive Literature Review of Human Biomonitoring (HBM) Datasets from National Programs.

Chemical Prioritization Dataset Development

Recommendations for Short, Medium & Long-Term Goals of Developing a National Human Biomonitoring Program

Developing a National Survey: incorporate the public perception

Hosting a Stakeholder Forum: Engaging International and National Stakeholders
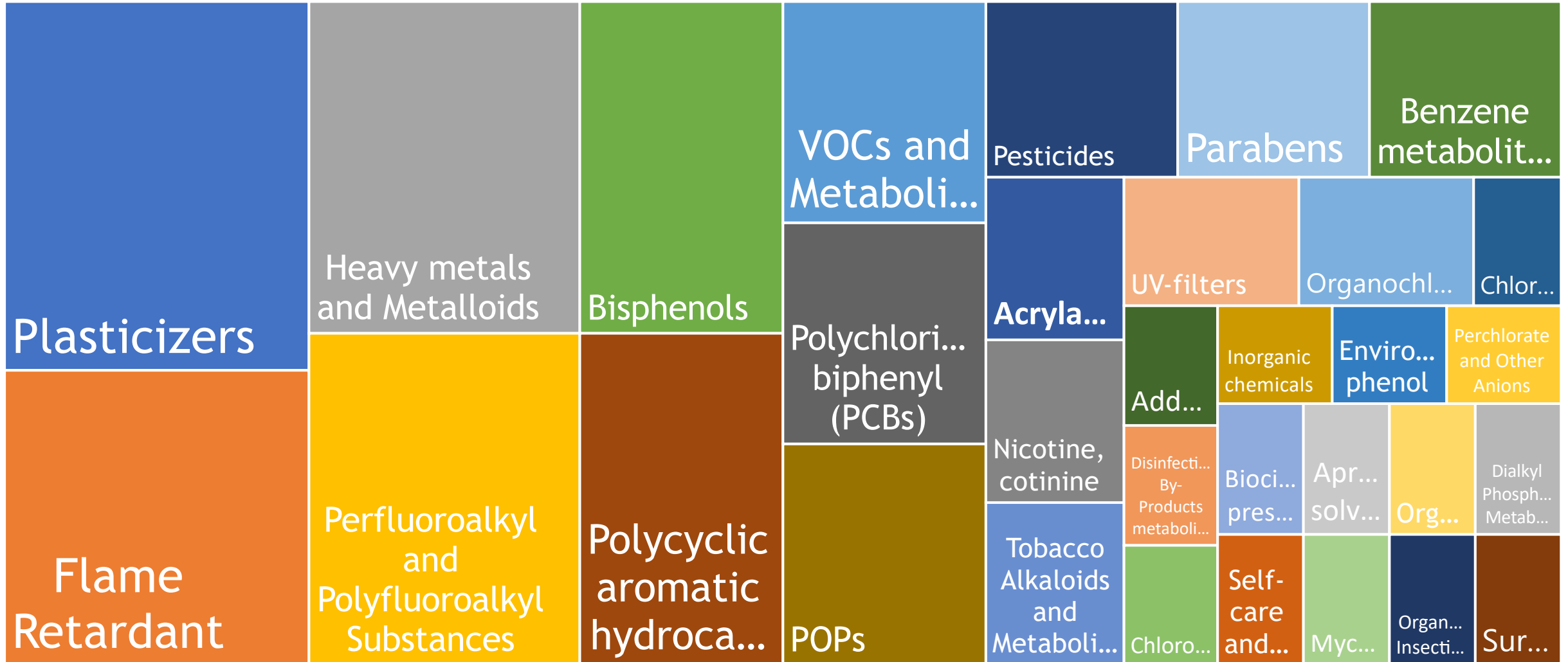
Our approach to prepare the chemical priority list for Ireland

Preliminary listing of the chemicals

Step 1	→	Mapping the list of different chemicals - HBM4EU and PARC
Step 2	→	Reviewing the National HBM programmes
Step 3	→	Mapping and scoring of chemicals in HBM programmes of different countries

Intermediate and final listing of the chemicals

Step 4	→	National survey of the chemicals
Step 5	→	Analyses of survey results and preparation of intermediate list of chemicals
Step 6	→	Conducting a stakeholder consultation workshop
Step 7	→	Shortlisting the chemicals in consultation with the experts and the national needs

Chemical Priority list – Preliminary chemical groups

Well-Known Chemicals: These are chemicals widely known by the general public, often due to their use in consumer products, environmental contamination, or media coverage.

- **Mercury and Mercury Compounds** (Environmental contaminant)

- **Pesticides** (Agriculture, gardening chemicals)

- **Arsenic** (Used in manufacturing, pesticides)

- **Cadmium** (Used in batteries, pigments)

- **Lead** (Used in batteries, previously in gasoline and paints)

- **Chromium VI** (Industrial emissions, pigments, dyes)

- **Persistent Organic Pollutants (POPs)** (DDT, PCB, etc.)

- **Polycyclic Aromatic Hydrocarbons (PAHs)** (Air pollutants, combustion by-products)

- **Phthalates** (Plasticizers in flexible plastics, PVC products)

- **Bisphenols** (BPA in plastics, epoxy resins)

- **Perfluorinated and Polyfluorinated Substances (PFAS)** (PFOA, PFOS; in water-repellent products)

- **Volatile Organic Compounds (VOCs)** (Paints, cleaning supplies, building materials)

- **Disinfection By-Products** (Water treatment reactions with organic matter)

Chemical Priority list – Preliminary chemical groups

Moderately Known Chemicals: These are chemicals that the general public may be somewhat familiar with, often because of niche applications or specific incidents of exposure, but are less commonly discussed than the well-known chemicals.

- **Flame Retardants** (Brominated compounds in electronics, furniture)

- **Cobalt** (Used in batteries, alloys, pigments)

- **Selenium** (Used in electronics, supplements)

- **UV Filters (Benzophenones)** (Used in sunscreens, cosmetics)

- **Parabens** (Preservatives in cosmetics, pharmaceuticals)

- **Tobacco Alkaloids and Metabolites** (Found in tobacco products)

- **Solvents** (Used in industrial processes, paints, coatings)
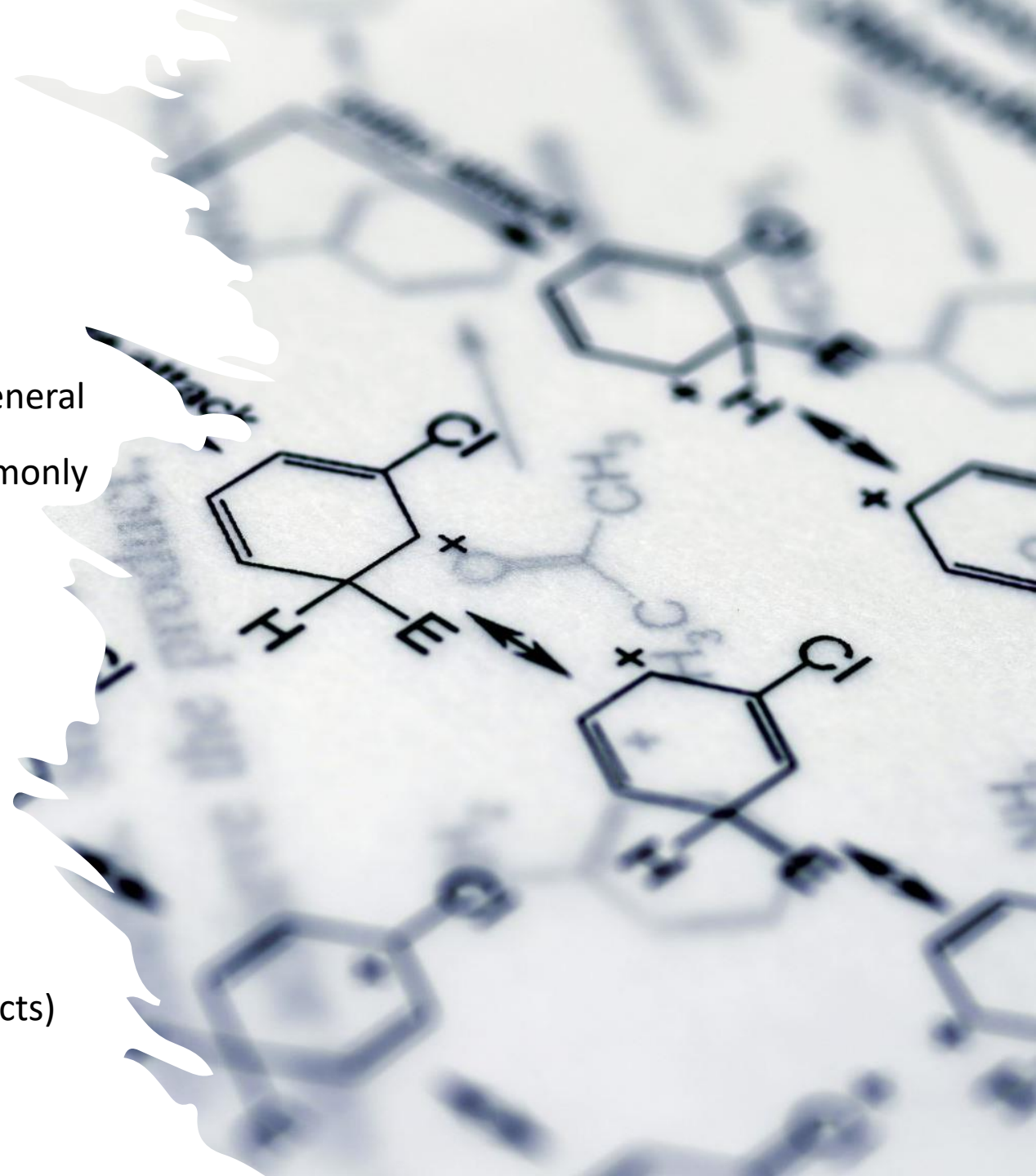
Chemical Priority list – Preliminary chemical groups

Lesser-Known but Emerging Concerns:

These chemicals are less known to the general public but are becoming increasingly important due to their emerging health or environmental risks. They may be of significant concern in scientific or regulatory discussions.

- **Di-isocyanates** (Used in industrial paints, glues, resins)

- **Acrylamide** (Used in various industrial processes, food processing)

- **Quaternary Ammonium Compounds** (Fabric softeners, disinfectants, personal care products)

- **Mycotoxins** (Fungal contaminants in food and feed)

- **Aniline Family** (Used in epoxy resins, industrial applications)

- **Perchlorate and Other Anions** (Rocket fuel, fireworks; water contamination)

- **Flame Retardants** (Increasing concern due to their persistence and potential health effects)

The **HBM4IRE project** at University College Dublin, funded by the EPA, is underway. We seek your opinions on chemicals of concern to help evaluate the possibility of establishing a national human biomonitoring program in Ireland. Human biomonitoring measures chemicals in body fluids (e.g., urine, blood) to assess population exposure levels.
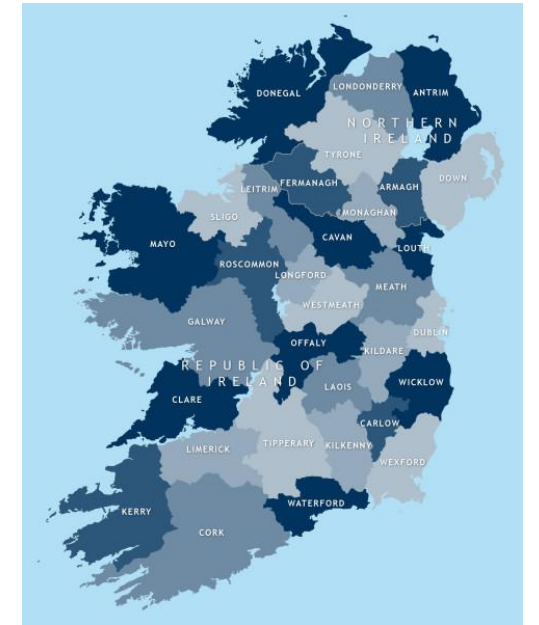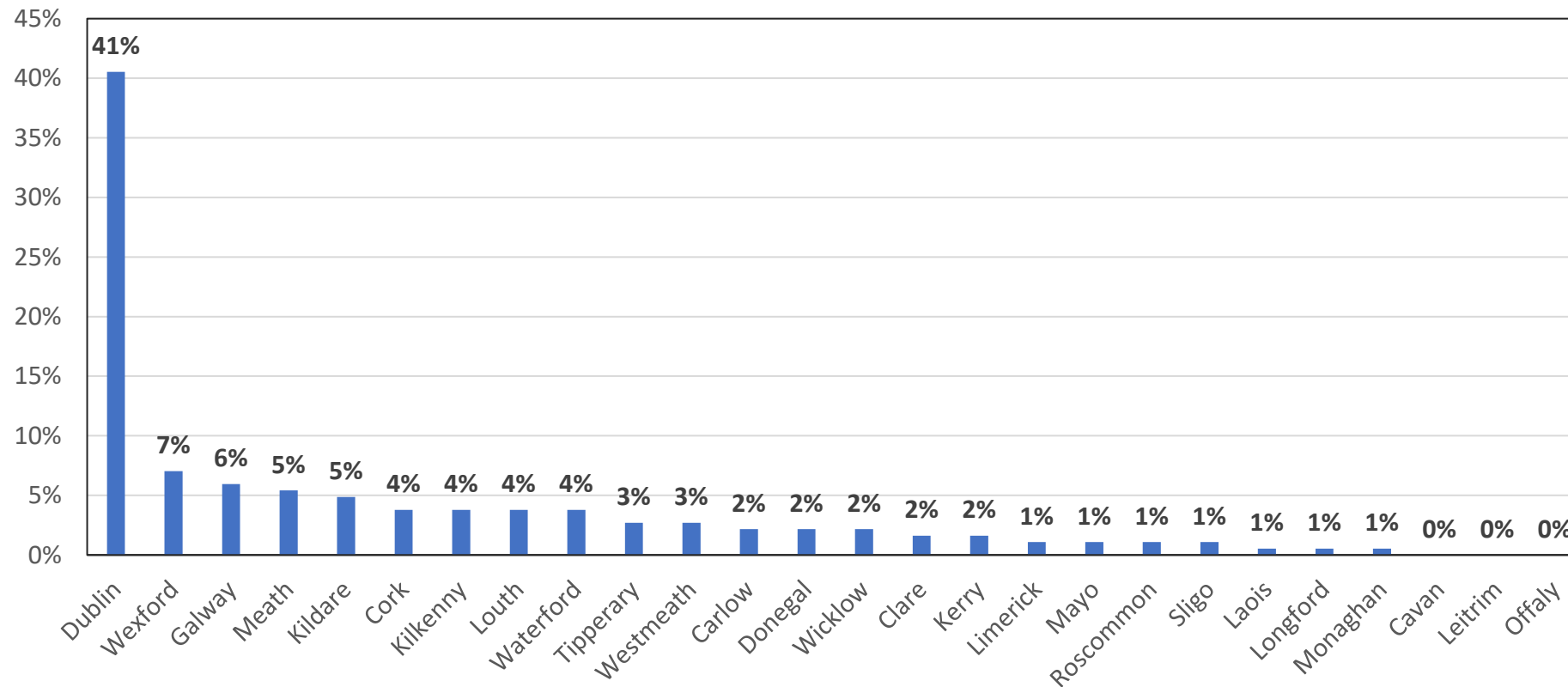
How to Participate:

1. Access the Survey: **Click the link - <https://eu.surveymonkey.com/r/972JSC9>** or scan the QR code to start the survey.

2. Complete in Minutes: It only takes 15 minutes to complete.

3. Make an Impact: Your feedback is crucial for shaping a healthier future for Ireland.
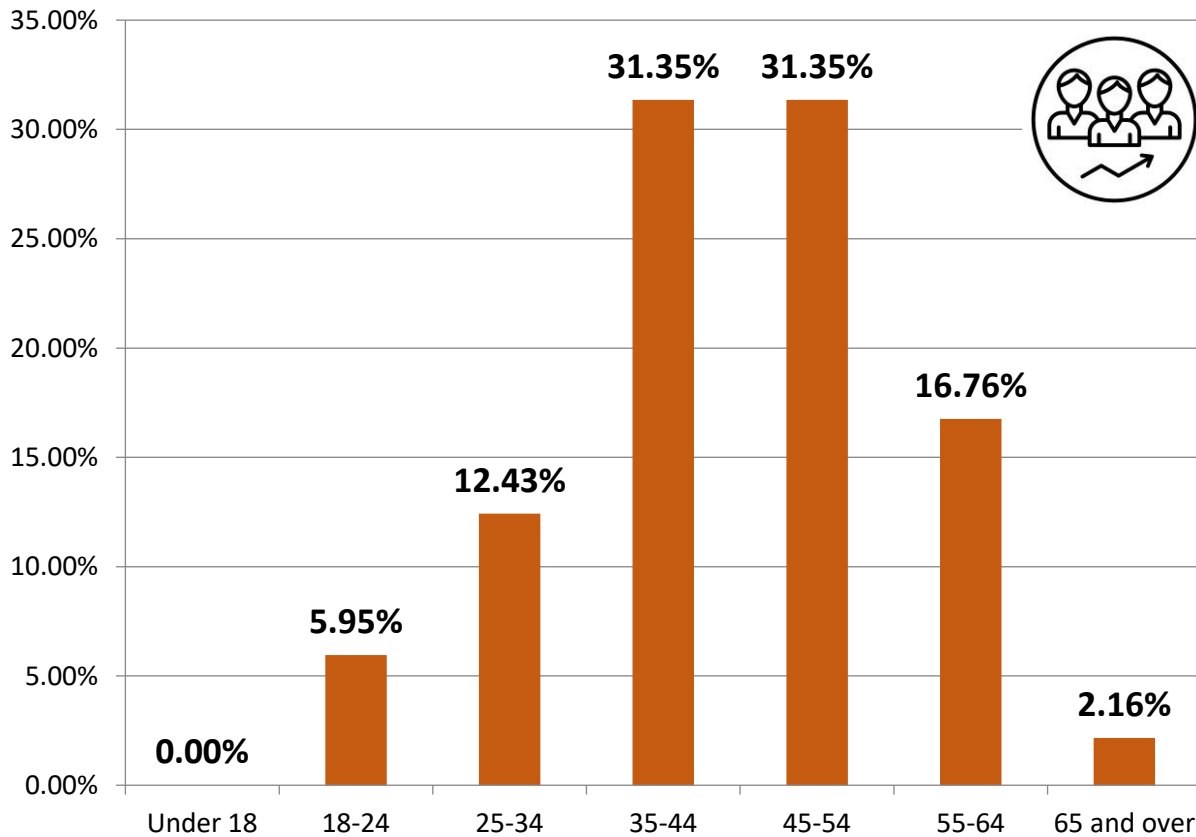
Conducted a national survey in Ireland
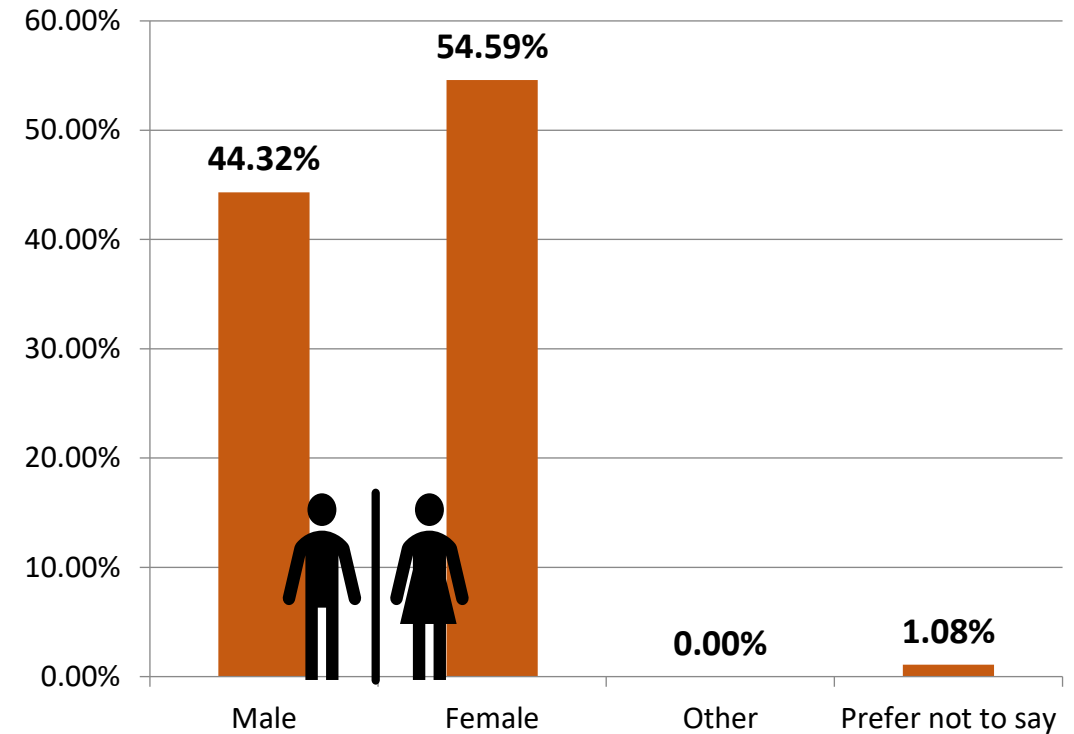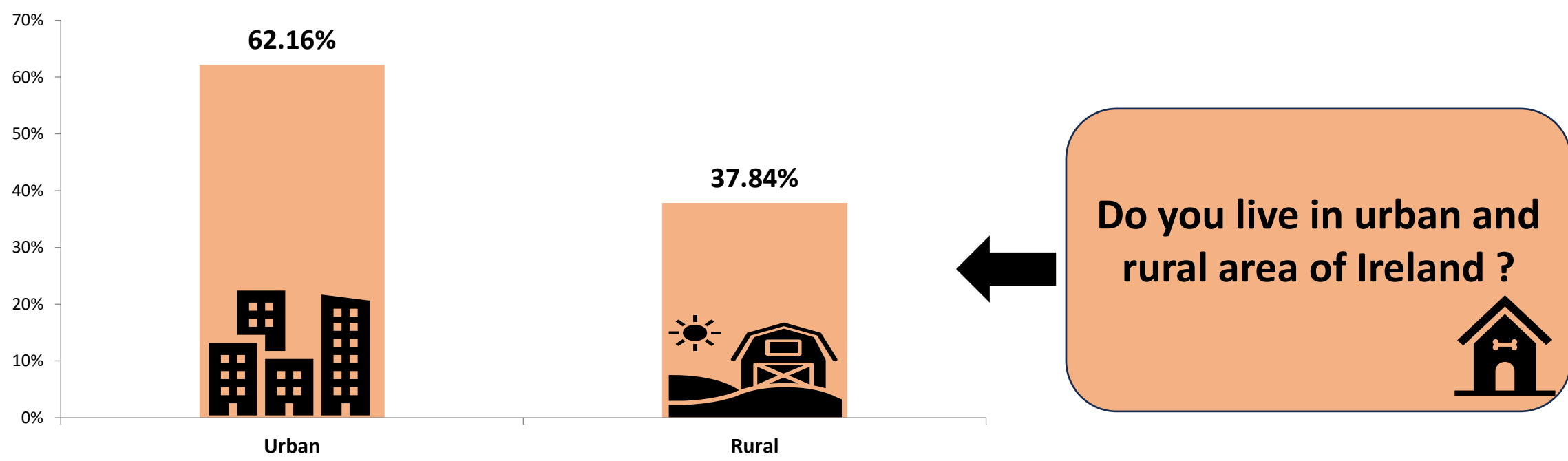
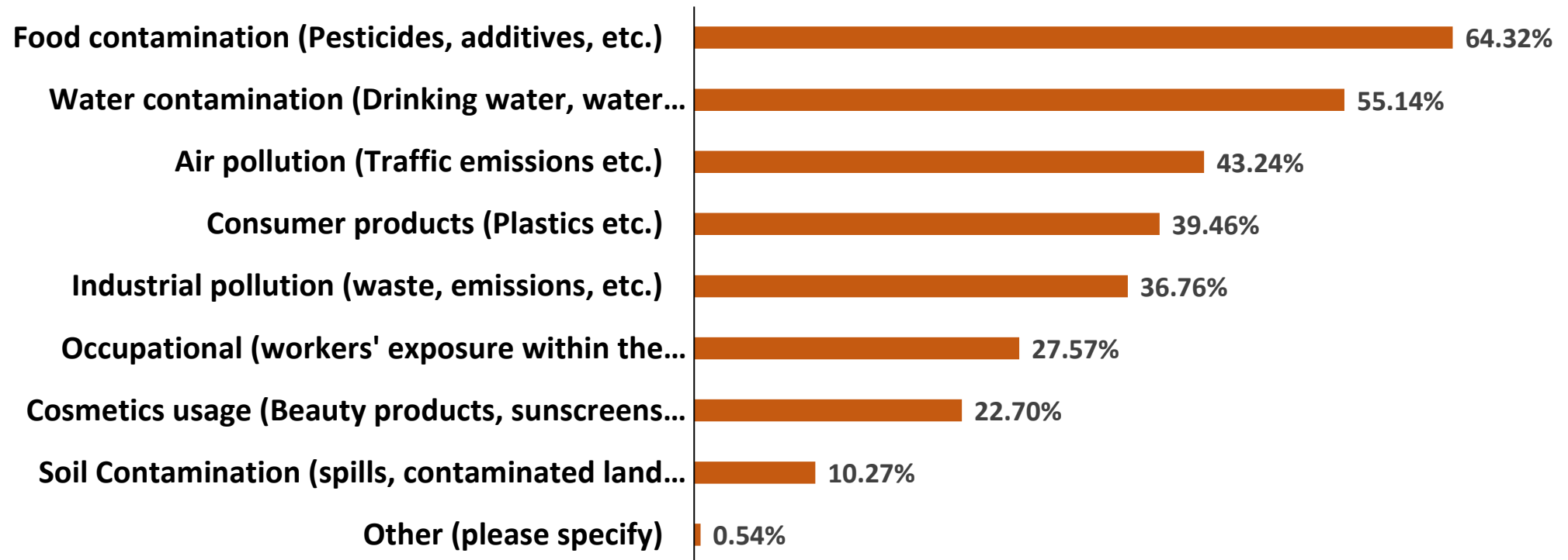# Geographical spread of Survey in Ireland

Demographic

Age

Category	Percentage
Under 18	0.00%
18-24	5.95%
25-34	12.43%
35-44	31.35%
45-54	31.35%
55-64	16.76%
65 and over	2.16%

Gender

Category	Percentage
Male	44.32%
Female	54.59%
Other	0.00%
Prefer not to say	1.08%

Demographics
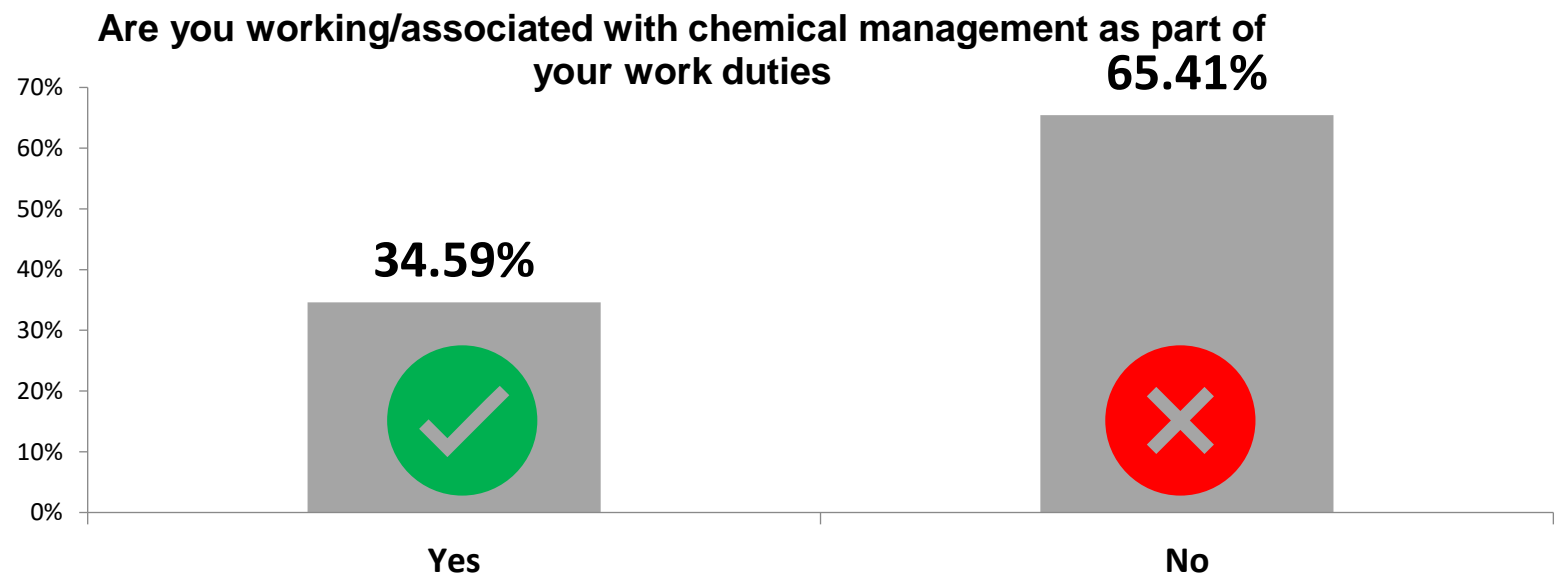
Public concerns related to chemical exposure

Category	Percentage
Food contamination (Pesticides, additives, etc.)	64.32%
Water contamination (Drinking water, water…	55.14%
Air pollution (Traffic emissions etc.)	43.24%
Consumer products (Plastics etc.)	39.46%
Industrial pollution (waste, emissions, etc.)	36.76%
Occupational (workers' exposure within the…	27.57%
Cosmetics usage (Beauty products, sunscreens…	22.70%
Soil Contamination (spills, contaminated land…	10.27%
Other (please specify)	0.54%

Categorization of Public Concerns

Top Concerns

Food Contamination (64.32%)

Water Contamination (55.14%)

Air Pollution (43.24%)

Moderate Concerns

Consumer Products (39.46%)

Industrial Pollution (36.76%)

Occupational Exposure (27.57)

Lower Prioritized Issues

Cosmetics Usage (22.70%)

Soil Contamination (10.27%):

Other (0.54%)

Highlight the Most Frequently Ranked Chemicals

Top-Ranked Chemicals: Mercury and Mercury Compounds received the highest percentage for Rank 1, with 31 people (20%) considering it the most harmful chemical.

- Arsenic follows, with 21 people (13.5%) ranking it first in terms of health impact.

- Pesticides - 13 people (8.4%) placing it at third.

- Lead was ranked first by 14 people (9%), making it another significant concern for respondents.

- PAHs (Polycyclic Aromatic Hydrocarbons): Ranked first by 11 people (7.1%).

Chemicals of Moderate Concern

- PFAS and Phthalates: Both chemicals were selected by 9 people (5.8%) each, indicating they are considered moderately impactful in terms of health risks.

Less Concerned Chemicals: Flame Retardants, UV Filters, Quaternary Ammonium Compounds, etc. received 0% for Rank 1, suggesting that these chemicals were not viewed as the most harmful by any respondents.
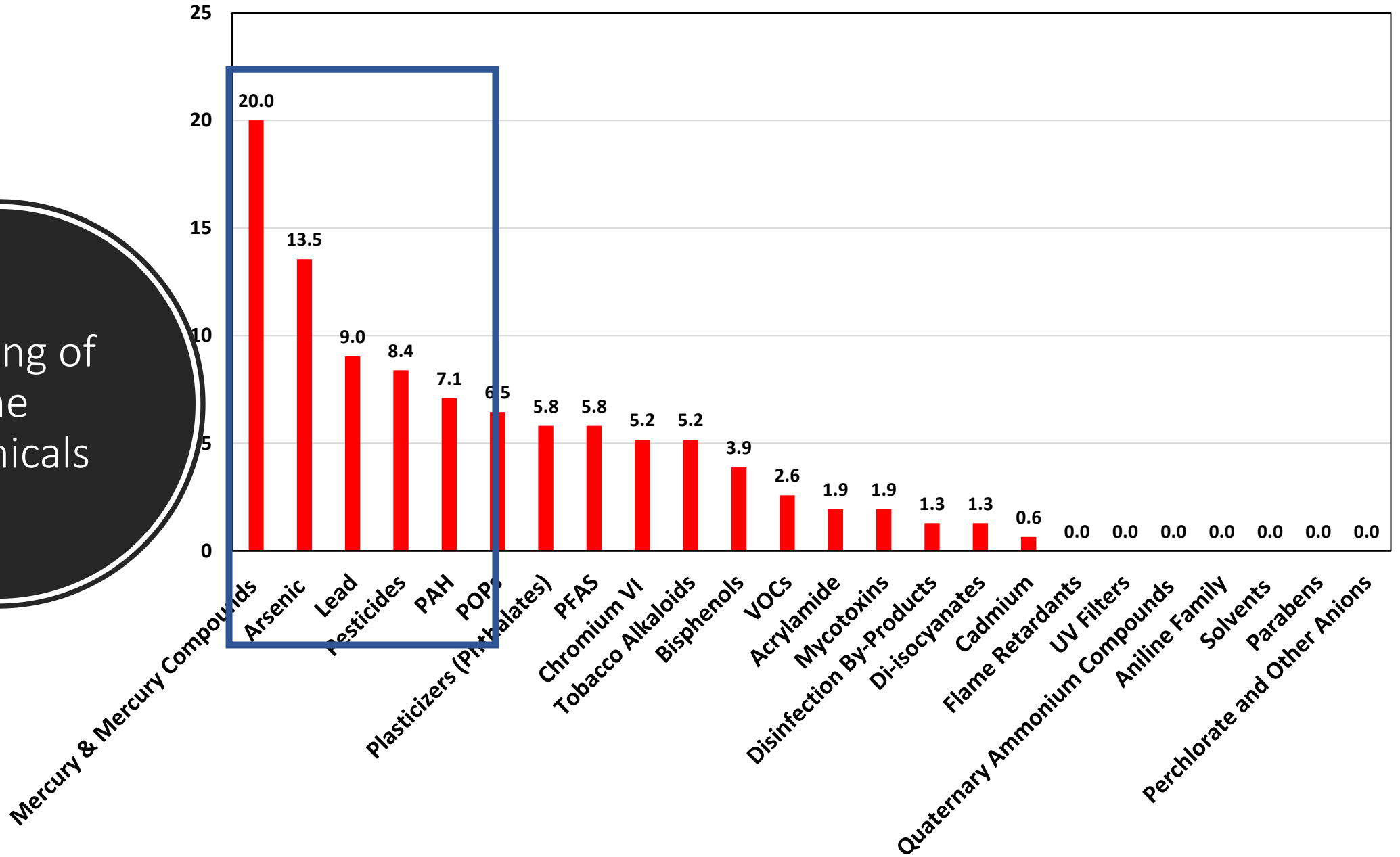
Chemical prioritization

Mercury and Mercury Compounds (Environmental contaminant, previously in consumer products)

Arsenic (A naturally occurring element used in pesticides, wood preservatives, and manufacturing processes)

Polycyclic Aromatic Hydrocarbons (PAH) (by-products of combustion processes found as air pollutants from combustion engines and some consumer products)

Cadmium (rechargeable batteries, coatings (electroplating), solar cells, and pigments)

Bisphenols (Found in polycarbonate plastics and epoxy resins, used in items like water bottles, food containers, an...

Perfluorinated and Polyfluorinated Substances (PFOS, PFOA, ...) (Surfactants and surface protectors in a variety of...

Lead (A metal used in batteries, radiation shielding, and previously in paints and gasoline)

Pesticides (Chemicals used to kill or control pests such as insects, weeds, or fungi, often used in agriculture and gardening)

Persistent Organic Pollutants (POPs) (such as DDT, PCB, etc which are persistent in nature and their usage has either been banned or strictly regulated)

Tobacco Alkaloids and Metabolites (Found in tobacco products and their residues)

Chromium VI (generated from industrial emissions, metal plating, manufacture of pigments and dyes,...

Volatile Organic Compounds - VOCs (emitted from paints, cleaning supplies, pesticides,...

Solvents (Used in paints, coatings, adhesives, cleaning products, and industrial processes)

Mycotoxins (produced by fungi which commonly infect food crops -...

Acrylamide (used in various industries...

Phthalates (Commonly used as plasticizers in the manufacturing of flexible plastics...

Flame Retardants (e.g. brominat... compoun...

Disi... By- Prod... (For... when disi...

Aniline Family (use...

Perc... and Othe...

Di- isocyan... (Used in forms, hardene...

Para... (Pres... used...

UV...

Quat...

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Less Concerned Chemicals: Flame Retardants, UV Filters, Quaternary Ammonium Compounds, Aniline Family, Solvents, Parabens, and Perchlorate received 0% for Rank 1, suggesting that these chemicals were not viewed as the most harmful by any respondents.
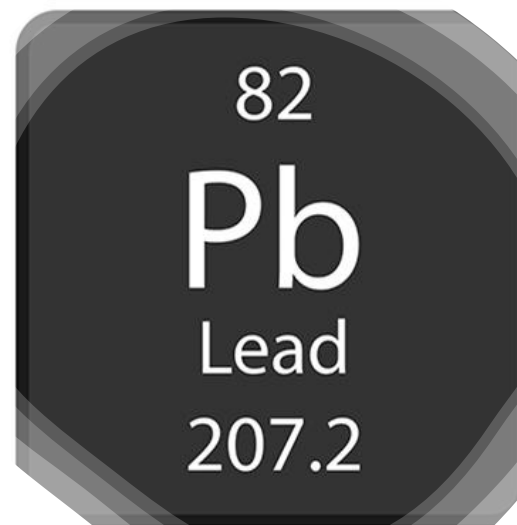
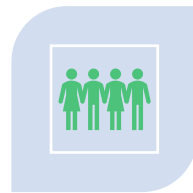# Review of the state-of-the-art in current HBM Programmes

FACTORS REVIEWED
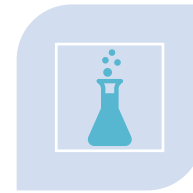
CHEMICAL GROUPS/ CHEMICALS ANALYZED

STRATEGY/ CRITERIA FOR SELECTING THE CHEMICALS

METHODS OF MEASUREMENT AND SAMPLE SIZE

COLLECTION PROTOCOL AND COHORT

FUNDING AGENCY

IMPACT ON THE POLICY

QA/ QC AVAILABILITY

HBM programme in other countries

A national human biomonitoring program is a systematic public health initiative designed to assess the exposure of a country's population to environmental chemicals by measuring these substances or their metabolites in human biological samples such as blood, urine, or other tissues.

UNITED STATES: The National Health and Nutrition Examination Survey (NHANES) by the Centers for Disease Control and Prevention (CDC)

GERMANY: German Environmental Survey (GerES), conducted by the German Environment Agency (UBA)

CANADA: Canadian Health Measures Survey (CHMS)

BELGIUM: Flemish human biomonitoring program, part of the Flemish Centre for Environment and Health

SOUTH KOREA: Korean National Environmental Health Survey (KoNEHS)

FRANCE: French National Institute for Industrial Environment and Risks (INERIS)

CZECH REPUBLIC: Human Biomonitoring in the Czech Republic

Framework for HBM Programme

Establishing governance and securing funding

- **Legislative support:** Enact policies that mandate the creation and continuity of the HBM program.

- **Form a national steering committee and identify the stakeholders:** Include representatives from health, environment, and occupational safety agencies, academia, and public health organizations.

- **Secure sustainable funding:** Develop a funding strategy involving governmental budgets, grants, and potential partnerships with non-profit organizations and international bodies.

Defining Objectives and Scope

- **Clear objectives**: Establish the program's goals, such as monitoring specific chemicals, assessing exposure levels, and informing policy.
- **Target population**: Decide on the cohorts (e.g., general population, vulnerable groups such as children, pregnant women, and occupational groups).

Methodological Approaches
Selection of chemicals/substances
Using a participatory approach involving expert panels and stakeholders.
Prioritize substances based on health effects, exposure data, public health action, analytical feasibility, and regulatory relevance.

Sampling Strategy: Considering both national and regional coverage, with specific attention to high-risk areas.

Develop standardized protocols for sample collection, handling, transportation, and storage.

Integration with Public Health and Policy

- Linking HBM Data with health outcomes: Develop mechanisms to integrate HBM data with health surveillance systems.

- Policy development: Use HBM data to inform and update environmental and public health policies and regulations.

- Stakeholder engagement: Involve stakeholders in the interpretation and use of HBM data to ensure relevant and impactful outcomes.

Data Management and Dissemination

- Establish robust data management systems to handle large datasets securely and efficiently.
- Ensure data transparency and accessibility to researchers, policymakers, and the public while maintaining confidentiality.
- Bio banks: Create a national biobank to store samples for future research.

Sample Collection and Analysis

- Biological matrices: Selection of suitable biological matrices like urine

- Analytical methods: Selection/availability of suitable and reliable analytical methods

- Quality assurance/Quality control (QA/QC):.

- Centralized laboratories: Utilize specialized, accredited laboratories with QA/QC for sample analysis. Sample can be sent to other nearby countries to save the cost of establishing new laboratories

Stakeholder forum

Summary and the Way Forward

- A chemical prioritization list for Ireland
    - 18 Substance groups
        - 650 preliminary chemicals for prioritization
- National Programmes
    - 10 countries
        - Investigating 8 criteria alongside chemical lists
- Stakeholder Forum
    - 5 International experts
        - National programmes, ethics, Laboratory requirements, Environmental Justice, HBM policy impact
- Short-term, medium-term and long-term goals for establishing a National HBM Programme in Ireland
- Mapping of the relevant stakeholders

Thank you

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Dr. Richa Singh: richa.singh@ucd.ie