

# Beyond Four Walls and a Roof

Connecting People, Health, and the Indoor Environment

Carl Grimes, HHS, CIEC | Hayward Healthy Home Institute

# The Challenge We Face

## Scientists Measure

- Buildings with precision
  - Objective data
- Temperature, humidity, VOCs

## Occupants Describe

- Experiences and symptoms
  - Subjective experience
  - 'I feel uncomfortable'

# What is Indoor Environmental Quality (IEQ)?

## Thermal Comfort

Temperature, humidity

## Indoor Air Quality

Pollutants, VOCs

## Acoustic Environment

Noise, sound quality

## Visual Environment

Lighting, brightness

But IEQ is more than just the building...

# The Missing Element: Human Experience

**Physical Systems + Human Experiences = True IEQ**

Buildings don't exist in isolation

People interact with and adapt to their environment

Health is about occupants, not just structures

# The Gap Between Measurement and Experience

## Building Measurements

- Temperature: 72°F
- Humidity: 45% RH
- VOCs: 250 µg/m<sup>3</sup>
- Light: 500 lux

## Human Experiences

- 'I feel too warm'
- 'The air feels stuffy'
- 'I have a headache'
- 'Hard to concentrate'

# ASHRAE Guideline 10: A Framework

## **Interactions Affecting Achievement of Acceptable Indoor Environments**

Addresses how building factors work together

Goes beyond isolated measurements

Focuses on acceptable environments for occupants

Provides practical guidance for design and operation

# The Four Main Factors and Their Interactions

Thermal  
Environment

Indoor Air  
Quality

Acoustical  
Environment

Visual  
Environment

# Why Interactions Matter

Thermal + IAQ: Odors acceptable when cool/dry become intolerable when warm/humid

Acoustics + Materials: Sound-absorbing materials may trap moisture and VOCs

Thermal + Particles: Low humidity makes particles more irritating to airways

Design Trade-offs: Solutions for one factor can create problems in another

# Case Example: The Moisture-IAQ Connection

## Moisture Impacts

- Thermal: Humidity affects comfort
- IAQ: Drives microbial growth
- Materials: Causes degradation
- Multi-factor interactions

## Key Metrics

- Relative Humidity (RH)
- Dew Point Temperature
- Water Activity (aW)
- Moisture Content

# Why Measurements Alone Can't Tell the Full Story

## Individual Variability

Same temperature feels different to different people

## Context Matters

Expectations and control influence perception

## Chemical Sensitivity

Standards don't prevent all symptoms

## Temporal Variation

Symptoms vary over time

*"People are not passive receptors of their environment but interact continuously with it. Given the opportunity, people will adjust themselves to their environment and their environment to themselves."*

— ASHRAE Guideline 10

# Occupant-Building Interactions

## Occupants → Environment

- Opening/closing windows
- Adjusting thermostats
- Using fans and blinds
- Changing clothing

## Environment → Occupants

- Temperature perception
- Air quality symptoms
- Productivity impacts
- Health outcomes

# From Passive Recipients to Active Participants

Personal Adjustments: Modify clothing, position, activity

Environmental Control: Adjust thermostats, windows, lighting

Individual Optimization: Balance factors based on needs

Control Awareness: Knowing controls are available increases satisfaction

# Dr. Claudia Miller's QEESI

## Quick Environmental Exposure and Sensitivity Inventory

Developed at University of Texas, San Antonio

Screening tool for chemical intolerances

Used globally for research and clinical assessment

Links environmental exposures to health symptoms

# The Symptom Star: Visualizing the Connection

## How It Works

- 10 symptom categories (0-10 scale)
- Visual 'fingerprint' of experience
- Shows patterns at a glance
- Tracks changes over time

## Key Benefits

- Before/after comparison
- Facilitates communication
- Documents changes
- Validates interventions

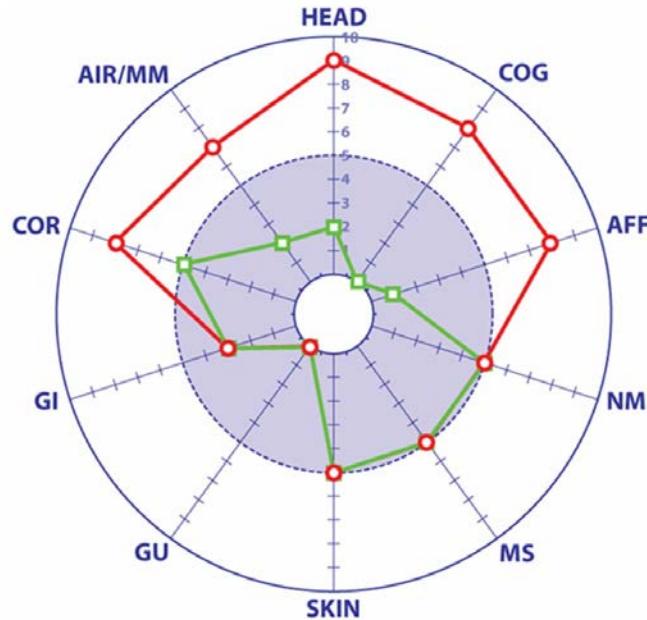
## — Symptoms —

The following questions ask about symptoms you may have experienced commonly. Rate the severity of your symptoms on a 0-10 scale. Do not leave any items blank.

For each item, circle one number only:

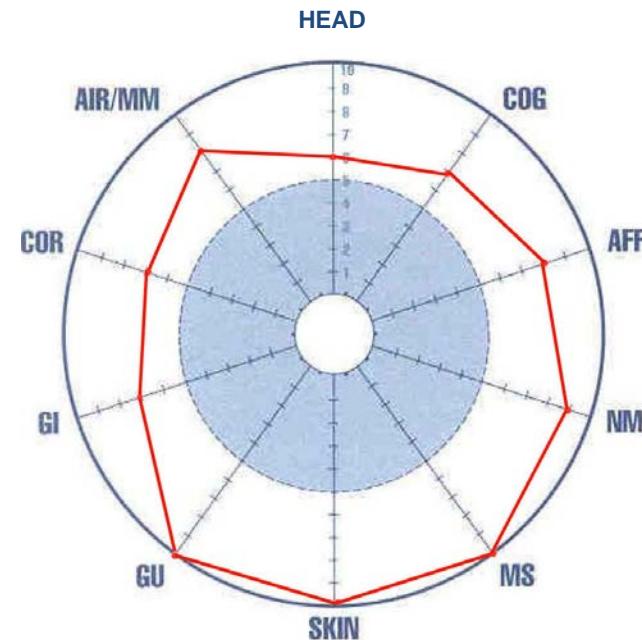
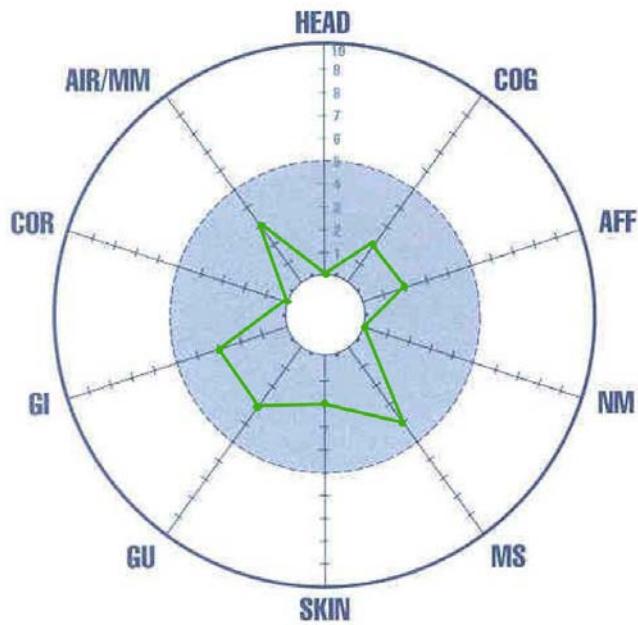
[0 = not at all a problem] [5 = moderate symptoms]

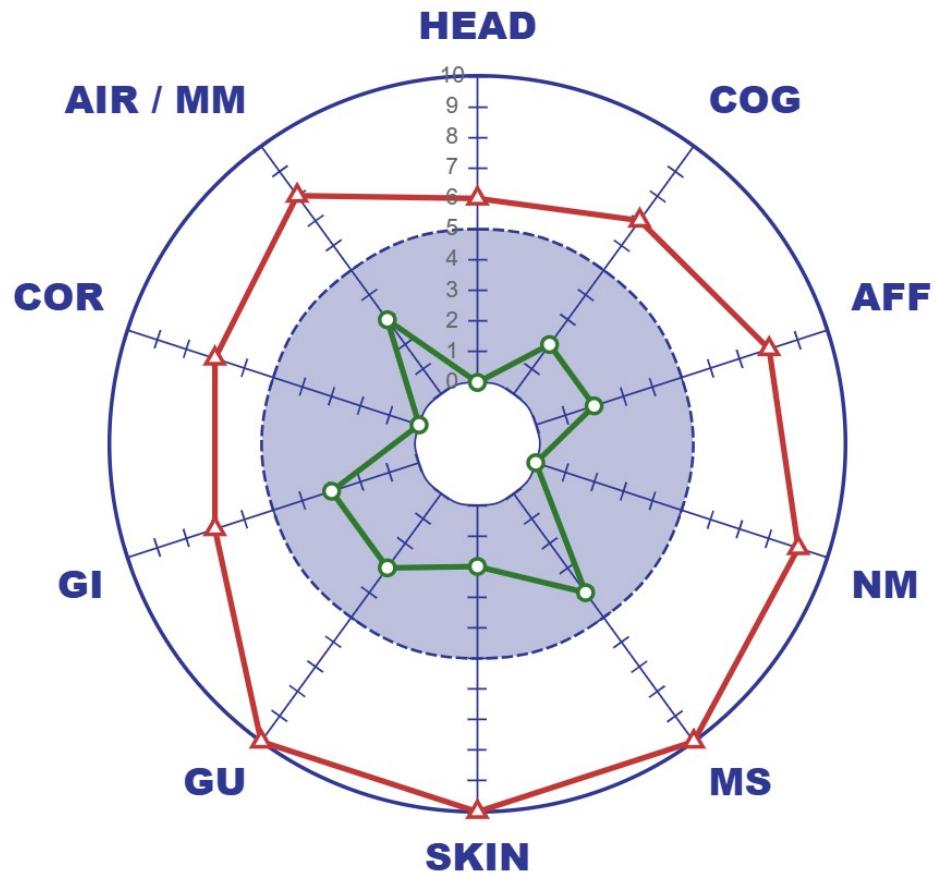
[10 = disabling symptoms]



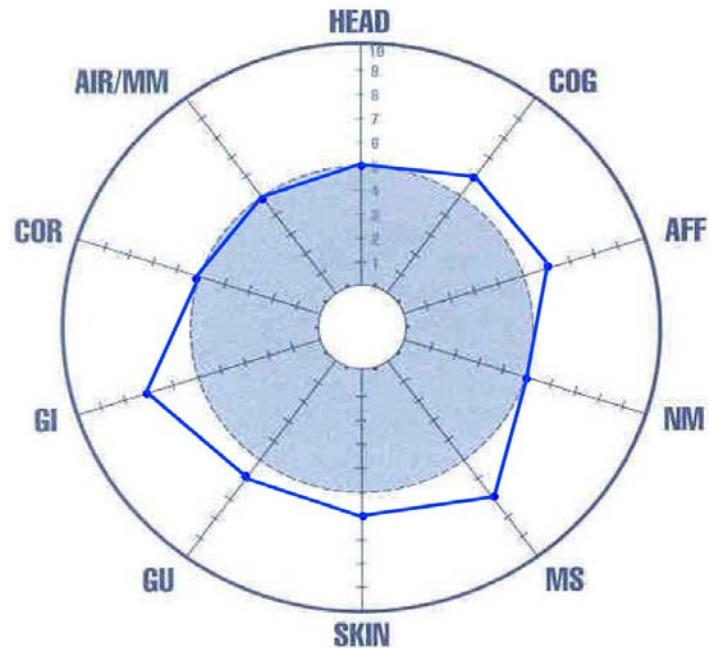
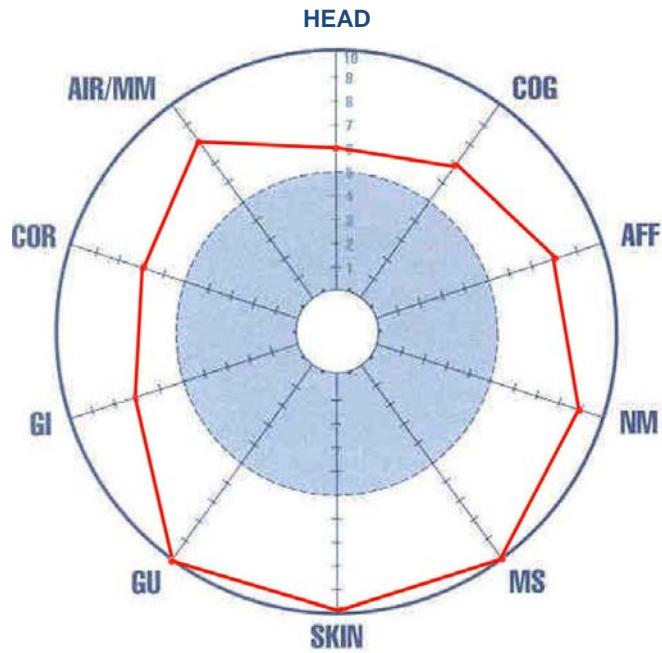
- Problems with your muscles or joints, such as pain, aching, cramping, stiffness or weakness? MS  
0 1 2 3 4 5 6 7 8 9 10
- Problems with burning or irritation of your eyes, or problems with your airway or breathing, such as feeling short of breath, coughing, or having a lot of mucus, post-nasal drainage, or respiratory infections? AIR/MM  
0 1 2 3 4 5 6 7 8 9 10
- Problems with your heart or chest, such as a fast or irregular heart rate, skipped beats, your heart pounding, or chest discomfort? COR  
0 1 2 3 4 5 6 7 8 9 10
- Problems with your stomach or digestive tract, such as abdominal pain or cramping, abdominal swelling or bloating, nausea, diarrhea, or constipation? GI  
0 1 2 3 4 5 6 7 8 9 10
- Problems with your ability to think, such as difficulty concentrating or remembering things, feeling spacey, or having trouble making decisions? COG  
0 1 2 3 4 5 6 7 8 9 10
- Problems with your mood, such as feeling tense or nervous, irritable, depressed, having spells of crying or rage, or loss of motivation to do things that used to interest you? AFF  
0 1 2 3 4 5 6 7 8 9 10
- Problems with balance or coordination, with numbness or tingling in your extremities, or with focusing your eyes? NM  
0 1 2 3 4 5 6 7 8 9 10
- Problems with your head, such as headaches or a feeling of pressure or fullness in your face or head? HEAD  
0 1 2 3 4 5 6 7 8 9 10
- Problems with your skin, such as a rash, hives or dry skin? SKIN  
0 1 2 3 4 5 6 7 8 9 10
- Problems with your urinary tract or genitals, such as pelvic pain or frequent or urgent urination? (For women: or discomfort or other problems with your menstrual period?) GU  
0 1 2 3 4 5 6 7 8 9 10

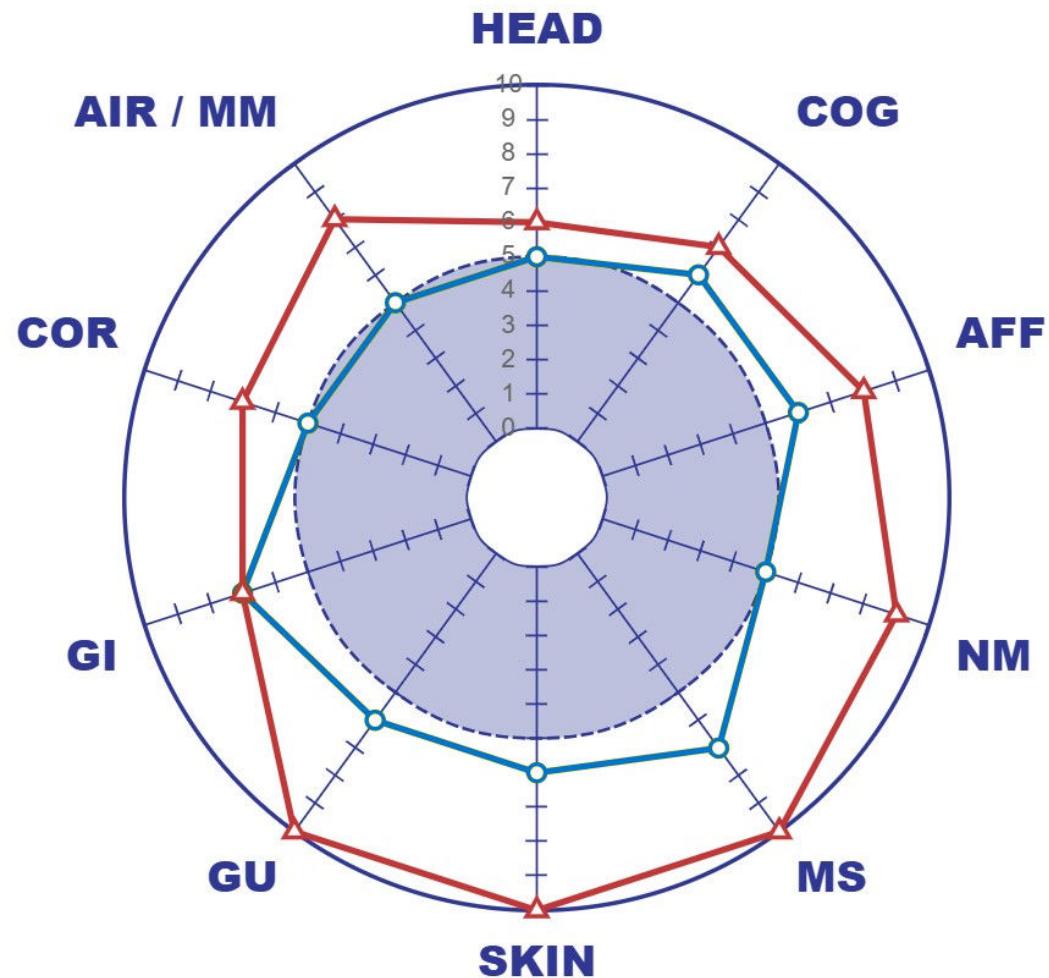
# Before Exposure vs After Exposure

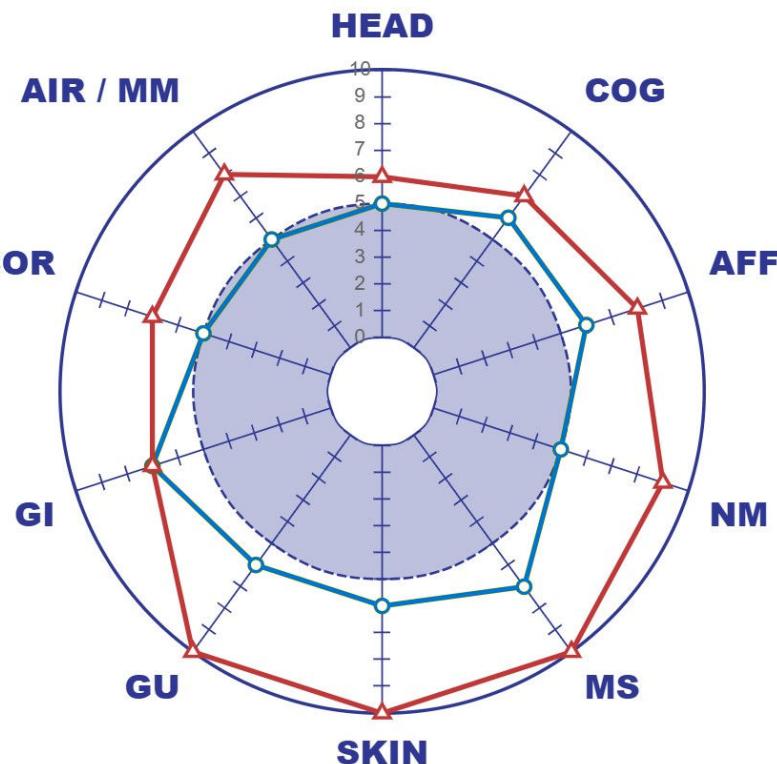
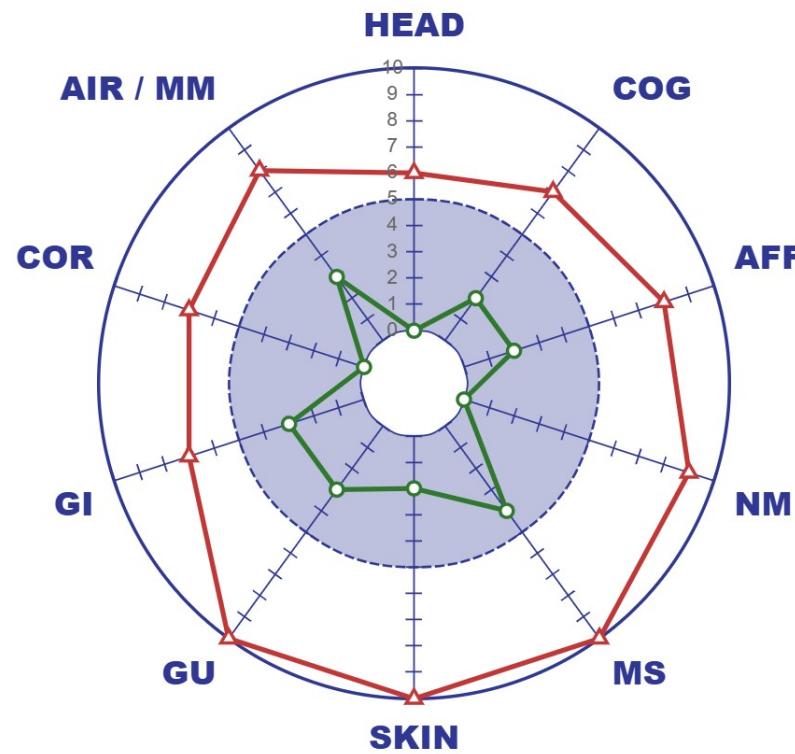




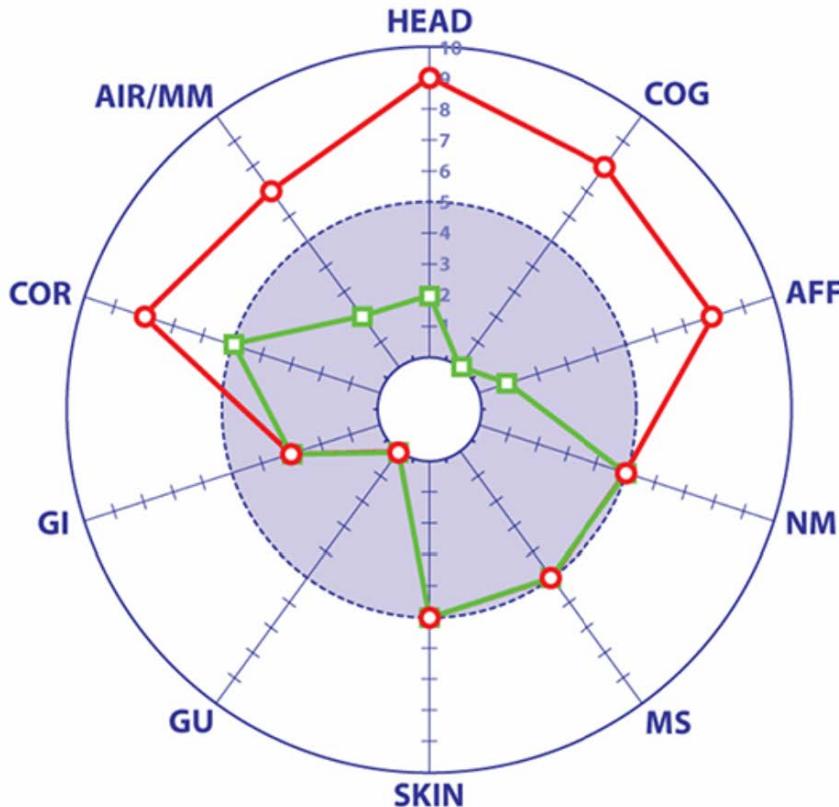
# After Exposure vs After Intervention







# Some Symptoms May Not Change



- In this case, certain symptom severities did not change: GI, GU, SKIN, MS, and NM before and after the exposure event or intervention.
- This suggests that these symptoms were not affected by the house or the intervention.
- Clients/patients feel better understood and can readily communicate this visual information to their families, doctors, and contractors.

# Real-Time Connection: Conditions to Experience

**Tracks Patterns:** Monitor symptoms through seasons and changes

**Documents Interventions:** Shows improvement or deterioration

**Links Conditions to Symptoms:** Connects building to health

**Validation Tool:** Provides evidence of effectiveness

Free Web Site at [qr.link/GLYV7h](http://qr.link/GLYV7h)



# Case Study: Putting It Into Practice

## The Situation

68-year-old house cleaner

16 years fragranced products

## Symptoms

Headaches & fatigue

Respiratory issues

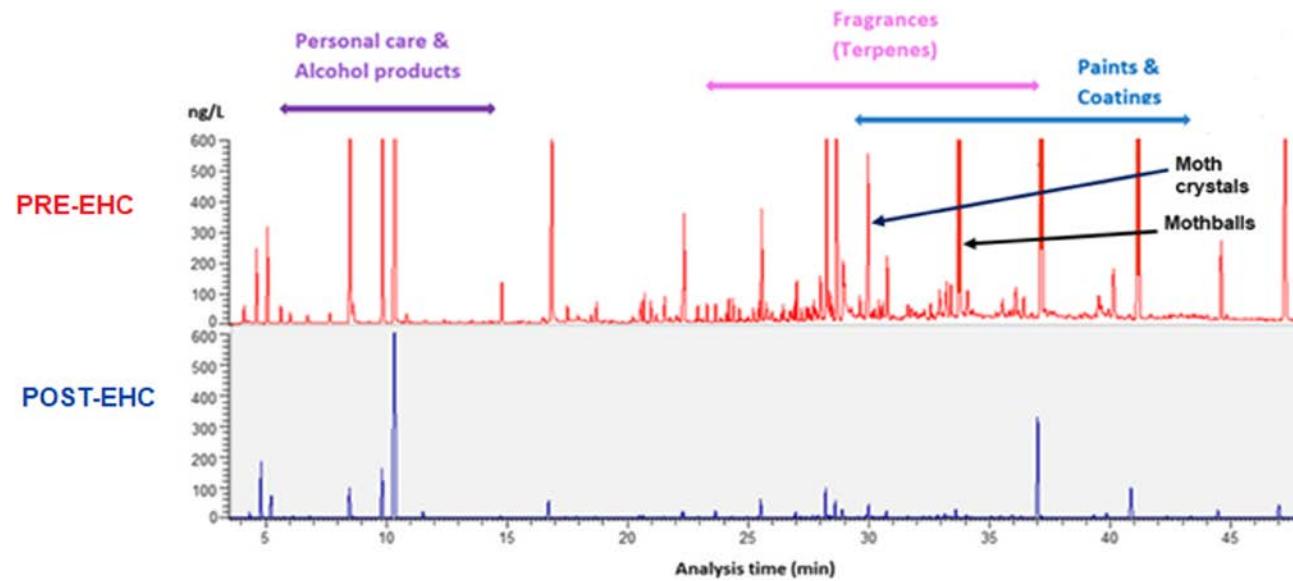
Memory difficulties

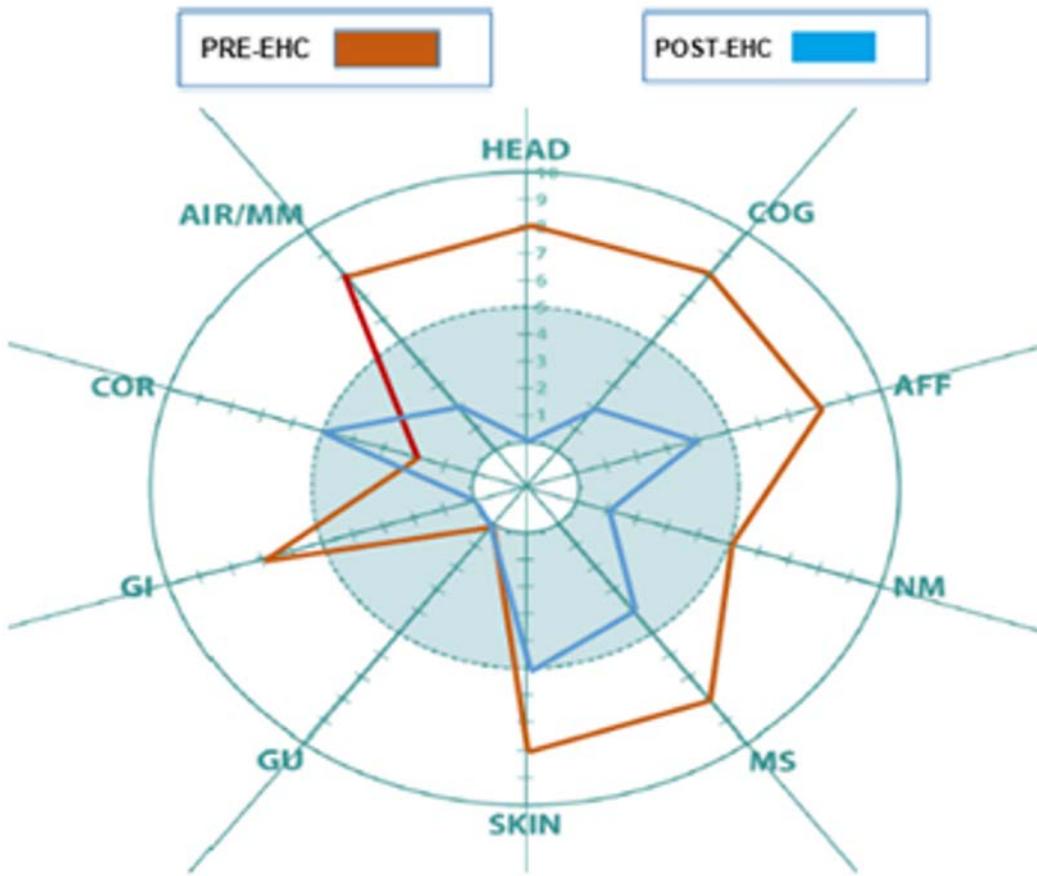
## Outcome

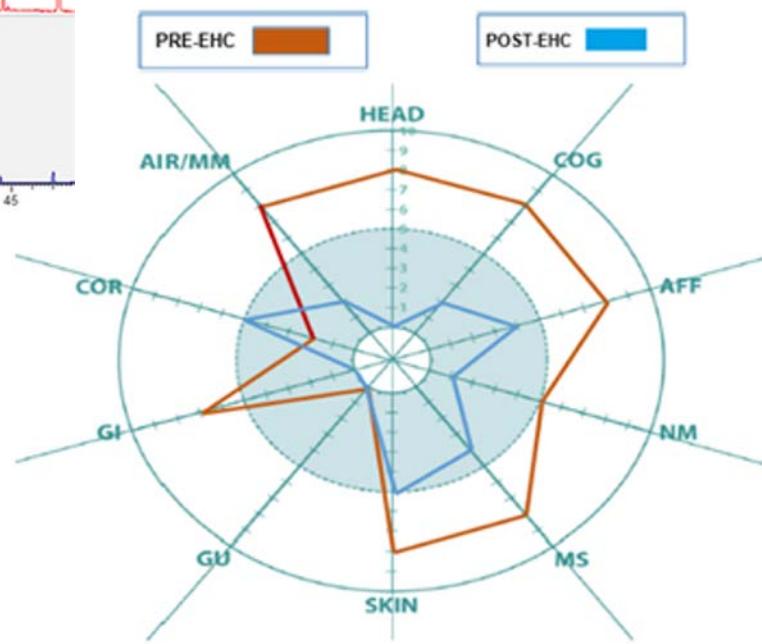
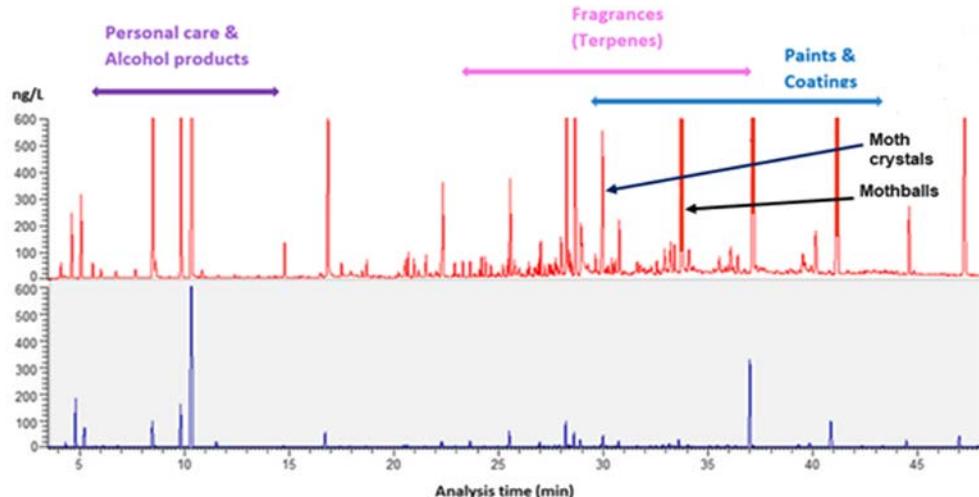
QESI identified chemical intolerance

Environmental interventions implemented

Symptom Star documented improvement









# Integrating Building Science and Human Experience

**Building Measurements  
(ASHRAE Guideline 10)**

+

**Human Experience  
(QEESI / Symptom Star)**

=

**Healthy Indoor Spaces**

# The Hayward Score Approach

## Free Assessment Tool Connecting Homes and Health

Comprehensive questions about building and symptoms

80,000+ homes assessed - largest database

Personalized results and recommendations

Actionable guidance for improvements

Available at [HaywardScore.com](http://HaywardScore.com)

# Tools for Transformation

## 1. Assess

- ASHRAE Guideline 10
- Hayward Score
- QESI
- Measurements

## 2. Connect

- Link conditions to experiences
- Identify patterns
- Validate relationships

## 3. Act

- Implement interventions
- Monitor outcomes
- Evidence-based improvements

# Creating Truly Healthy Indoor Spaces

**Holistic approach: physical environment + human experience**

**Consider interactions, not just individual factors**

**Empower occupants with control and information**

**Monitor and adapt based on real experiences**

**Design for people, not just code compliance**

# What You've Learned Today

1. IEQ encompasses both physical systems AND human experiences
2. ASHRAE Guideline 10 provides framework for understanding interactions
3. Measurements alone miss critical human factors
4. Symptom Star connects conditions to experiences in real time
5. Integration of both perspectives creates truly healthy spaces

# A New Way Forward

Health is about people, not just buildings

Bridge the gap between measurement and experience

Use tools that connect both perspectives

Create environments that truly support well-being

## Questions?

Carl Grimes, HHS, CIEC

[grimes@haywardscore.com](mailto:grimes@haywardscore.com)