How Healthy are National Green Building Programs?

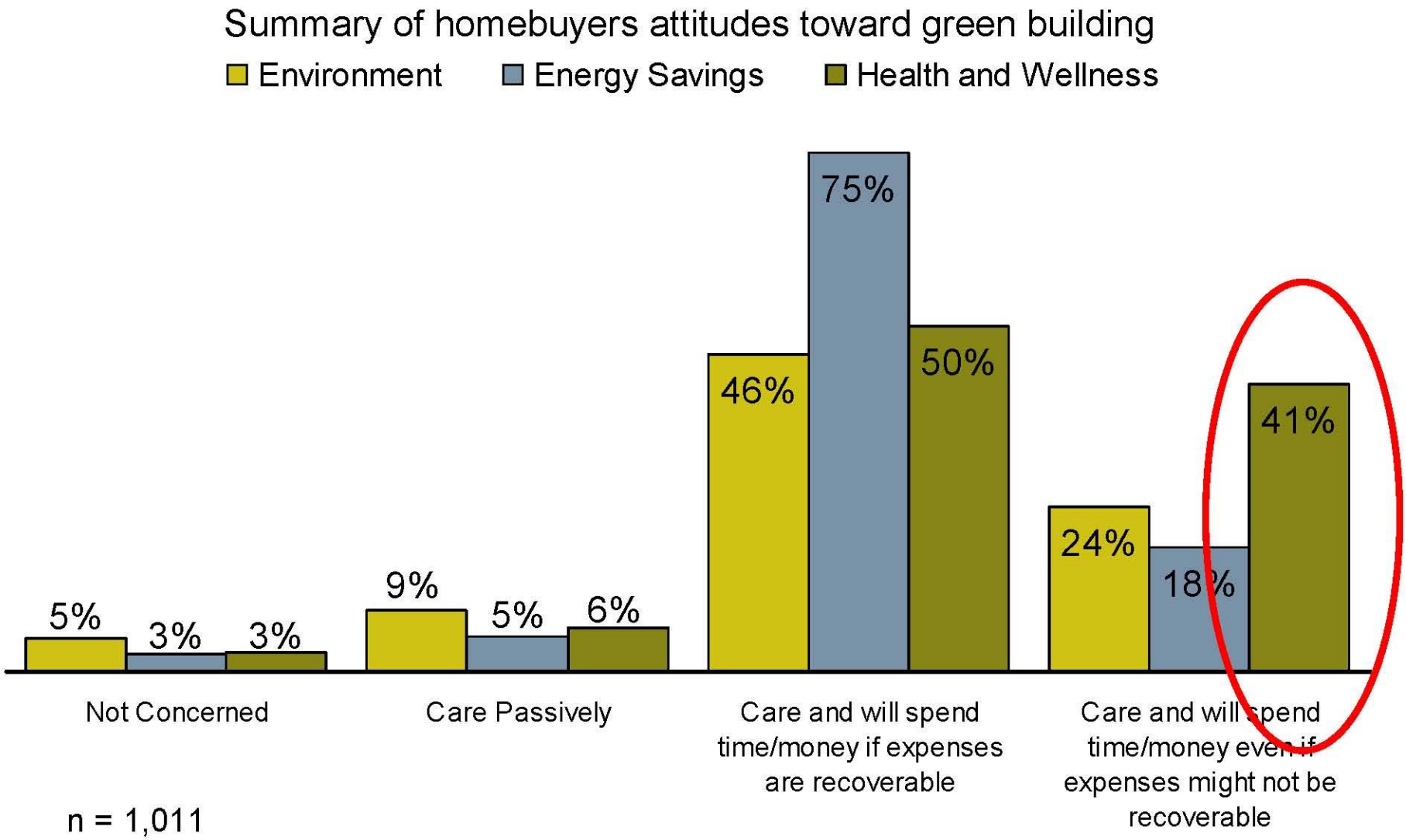
Presented by Rebecca Morley
National Center for Healthy Housing

Background

Increased Consumer Demand for Homes that are:

- Healthier for families
- Better for the environment
- Less expensive to operate

HOMEBUYERS PRIORITIES DIFFER FROM OWNERS OF INCOME-PRODUCING PROPERTIES



Purpose of NCHH Report

- Compare Green Programs to core set of Healthy Homes criteria
- Identify programs offering greatest protection of resident health
- Help gov't agencies, builders, architects, and homeowners make informed decisions

NCHH Healthy Housing Criteria

- Dry
- Clean
- Ventilated
- Pest-Free
- Contaminant-Free
- Safe
- Maintained

Public and Private Sector Building Guidelines

- Enterprise Community Partners Green Communities Criteria
- USGBC LEED for Homes
- National Green Building Standard
- US EPA Energy Star with Indoor Air Package

Method of Analysis-Scoring System

Score	Green Program Description
3	Includes **mandatory** criterion equivalent to NCHH criterion
2	Includes **mandatory** criterion similar to NCHH criterion
1	Includes **optional** criterion that is similar to NCHH criterion
0	Does not include similar criterion

Results

	Enterprise Green Comm	ENERGY STAR Indoor Air Plus	USGBC LEED Homes	National Green Building Standard
Dry (10 criteria-25 pts)	27 (108%)	24 (87%)	23 (84%)	19 (69%)
Clean (2 criteria-5 pts)	1 (20%)	0 (0%)	1 (20%)	1 (20%)
Ventilated (7 criteria-17.5 pts)	17 (97%)	21 (120%)	17 (97%)	13 (74%)
Safe (5 criteria-12.5 pts)	5 (40%)	5 (40%)	5 (40%)	3 (24%)
Contaminant-Free (7 criteria-17.5 pts)	18 (103%)	17 (97%)	10 (57%)	9 (51%)
Pest-Free (1 criterion-2.5 pts)	3 (120%)	3 (120%)	2 (80%)	1 (40%)
Maintained (2 criteria-5 pts)	6 (120%)	5 (100%)	6 (120%)	5 (100%)

Grading Key

A+	>100% of target score, ***all*** NCHH criteria included
A	90-100% of target score
B	80-89% of target score
C	70-79% of target score
D	<70% of target score

National Green Programs Health Grades

Health Principles	Green Communities	Energy Star IAP	USGBC LEED-H	NAHB Green Bldg
DRY	A+	A	B	C
CLEAN	D	D	D	D
VENTILATED	A	A+	A	C
SAFE	D	D	D	D
CONTAMINANT-FREE	A	A	D	D
PEST-FREE	A+	A+	B	D
MAINTAINED	A+	A	A+	A
VERIFIED	B	A+	A+	A+
OVERALL GRADE	B+	B+	B-	D+

Conclusions and Recommendations

- All green programs not created equal

  Safety not addressed:

  - ✓Lockable chemical storage cabinets
  - ✓Bathroom grab bars
  - ✓Water heater temp 120 degrees

  Contaminant-Free & Clean:

  - ✓Active sub-slab depressurization for radon
  - ✓Smoke-free multi-family properties
  - ✓Ventilation: ASHRAE 62.2

Minnesota Green Building Case Study

- Worthington, Minnesota, USA
- Mostly subsidized rentals
- 60 units in 3 buildings
- Constructed in 1974

Project Partners

Research Team

- National Center for Healthy Housing (NCHH)
- Center for Sustainable Building Research (CSBR)
- Southwest Minnesota Housing Partnership
- Greater Minnesota Housing Fund

Research Funding

- US Environmental Protection Agency
- Enterprise Community Partners
- Blue Cross Blue Shield Foundation of Minnesota

Before and After Renovation

Green Rehab Elements

- Low-VOC adhesives, paints & coatings
- Radon testing pre- and post-rehabilitation
- Radon mitigation
- No added urea formaldehyde cabinetry
- Ventilation: ASHRAE 62.2
- Pest management: Contracted with firm specializing in Integrated pest management
- Non-smoking common areas
- No carpet in wet areas
- Energy-Star fans exhausted to exterior equipped w/humidistat

Kitchen Renovations

Community Amenities

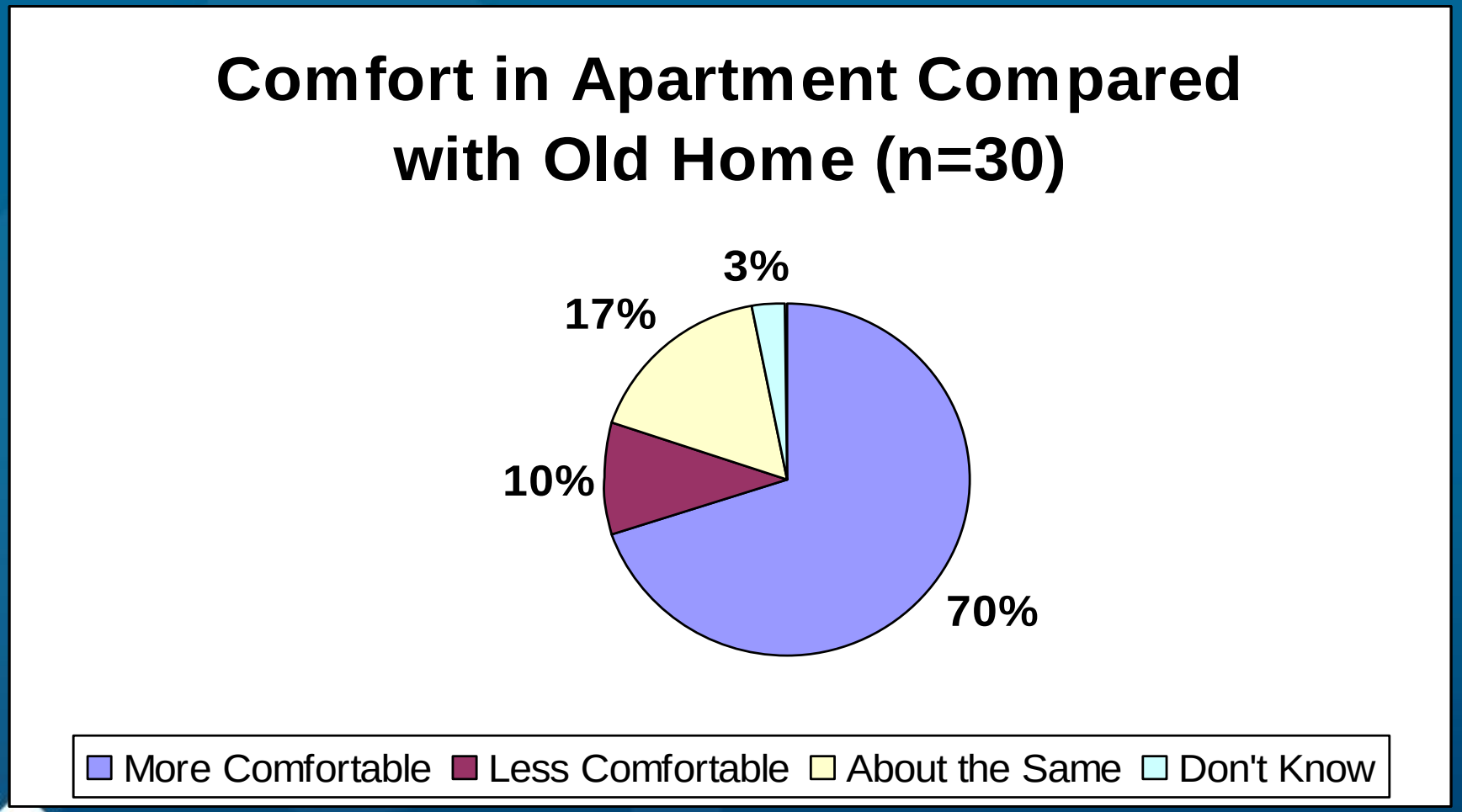
Data Collection and Training

- Health Questionnaire
- Visual Assessment
- Resident Training
- Building Performance Testing
- Radon Testing

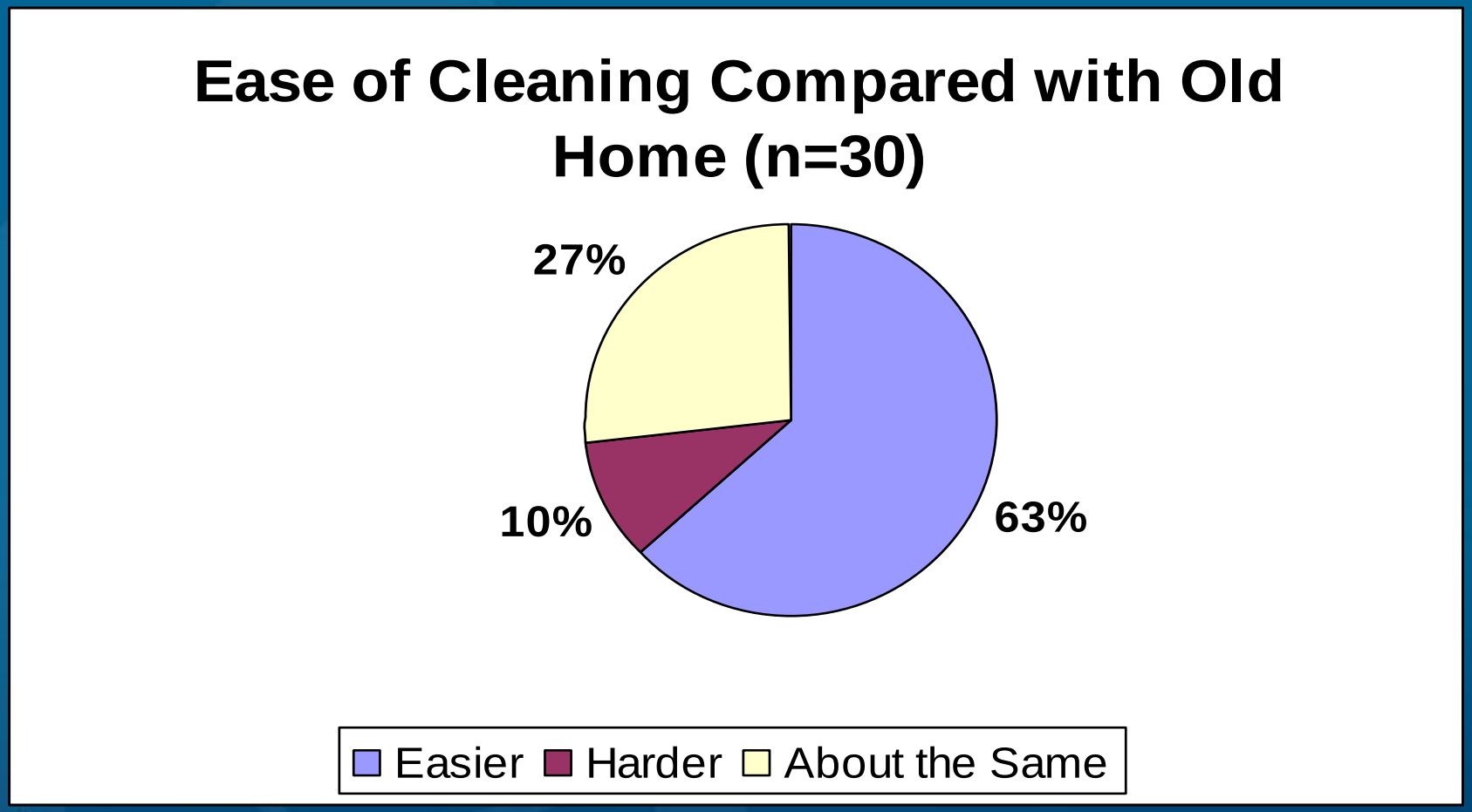
Resident Characteristics

- Winter celebration
- 30 of 54 occupied units enrolled
- 29 adults, 30 children
- Residents in 18 units had lived in renovated apts <1 month; 12 lived there 2 to 9 months
- 6 adults & 2 children w/history of asthma

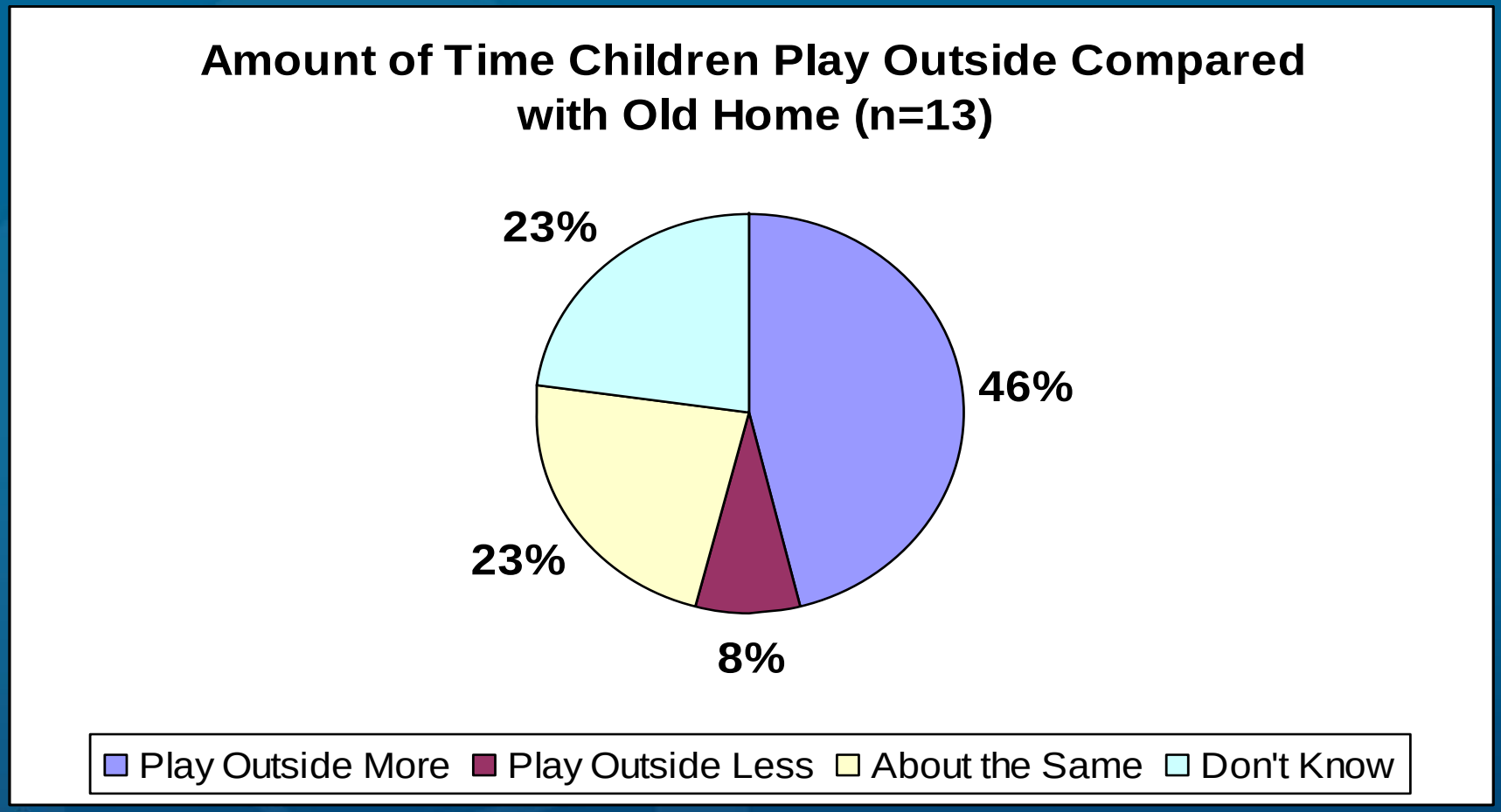
Baseline Questionnaire Results



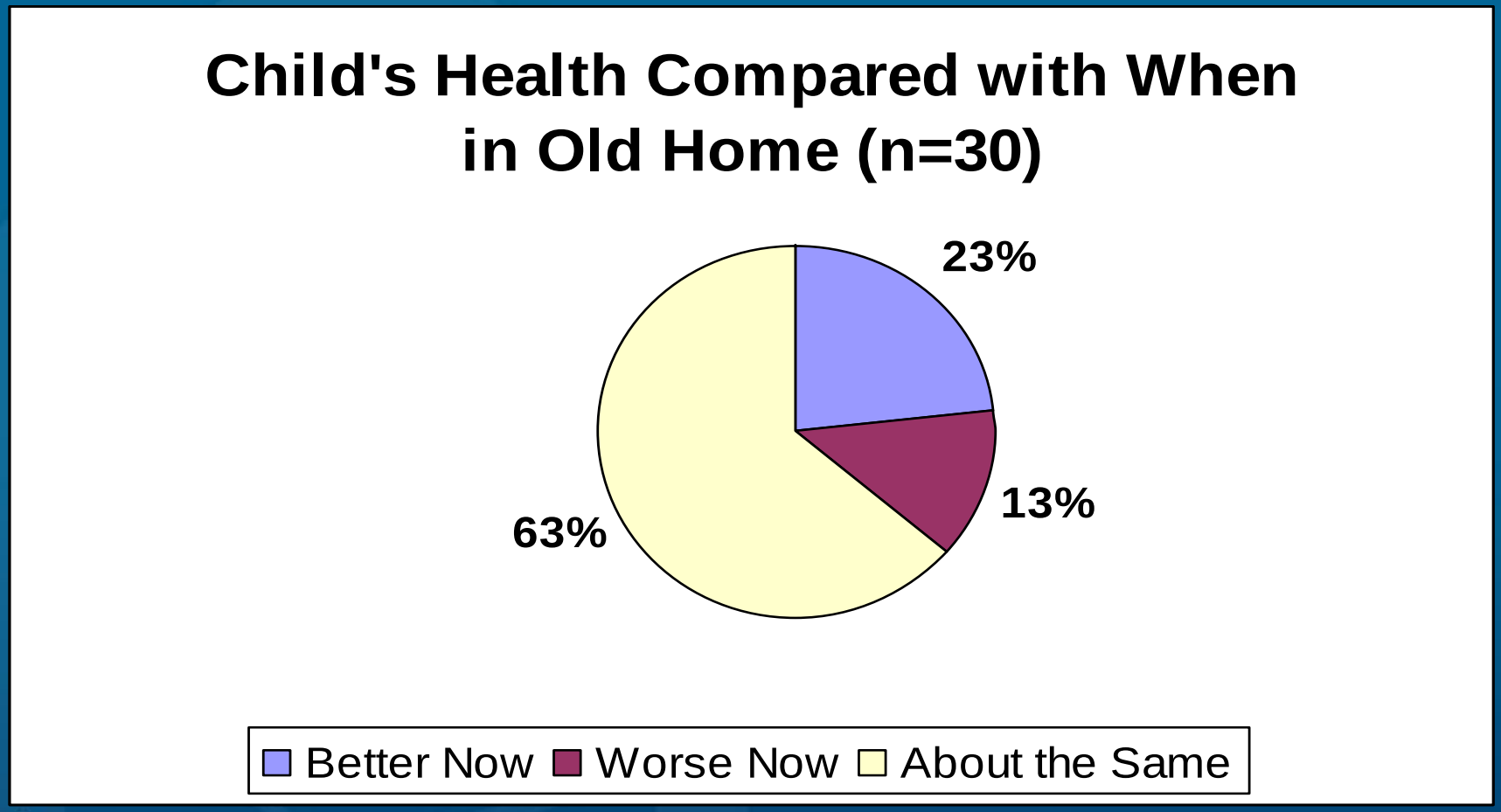
Baseline Questionnaire Results, cont'd



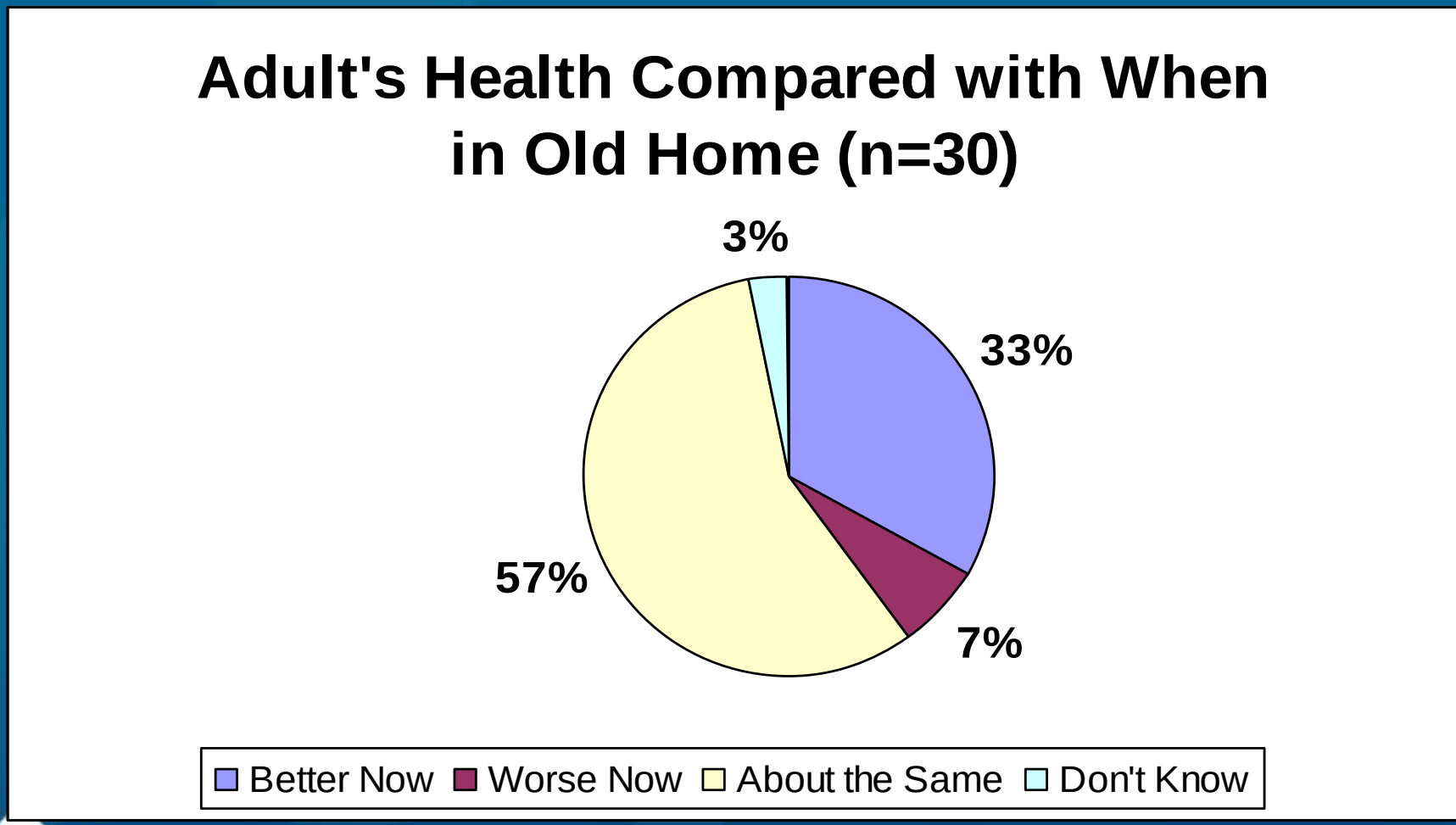
Baseline Questionnaire Results, cont'd



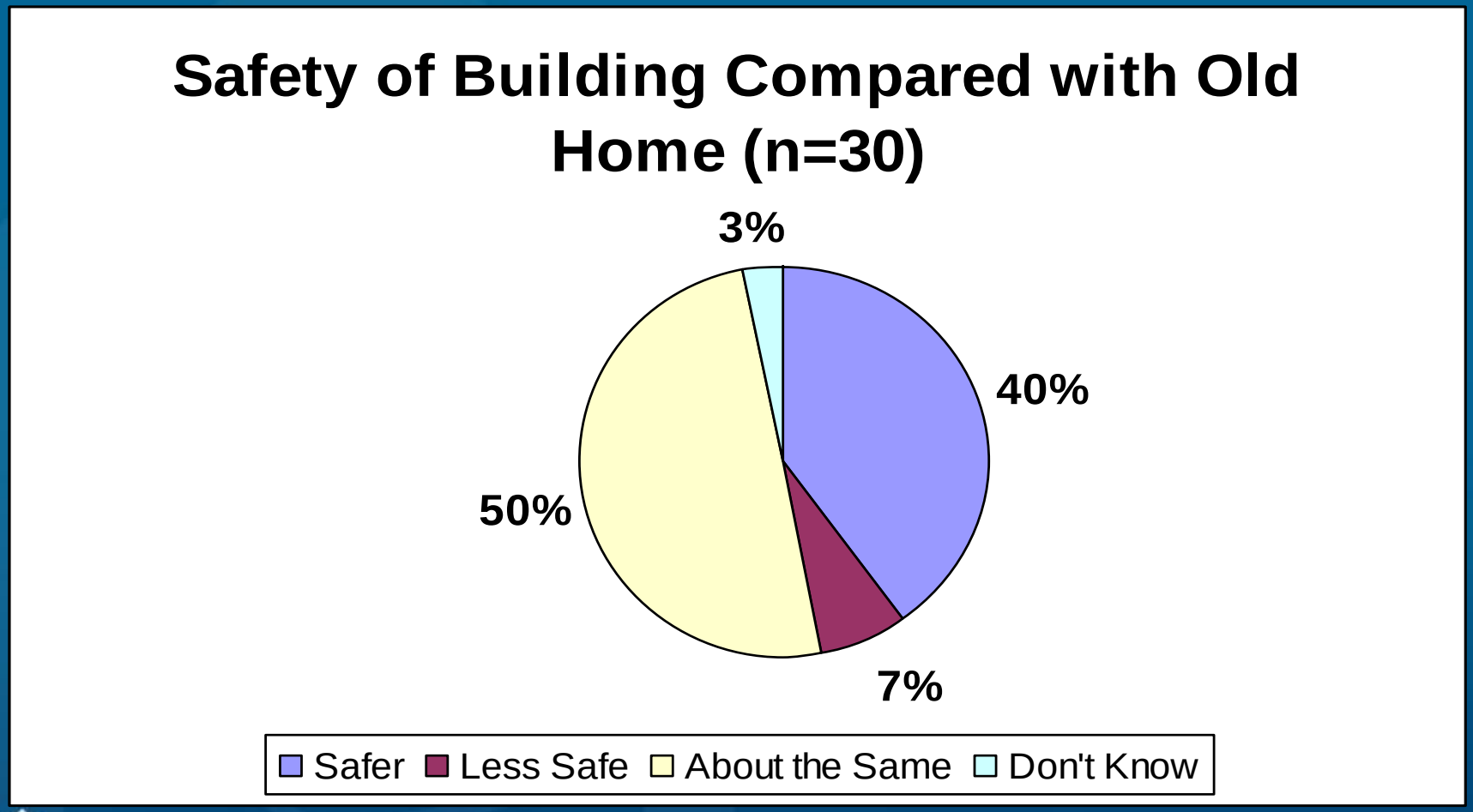
Baseline Questionnaire Results, cont'd



Baseline Questionnaire Results, cont'd



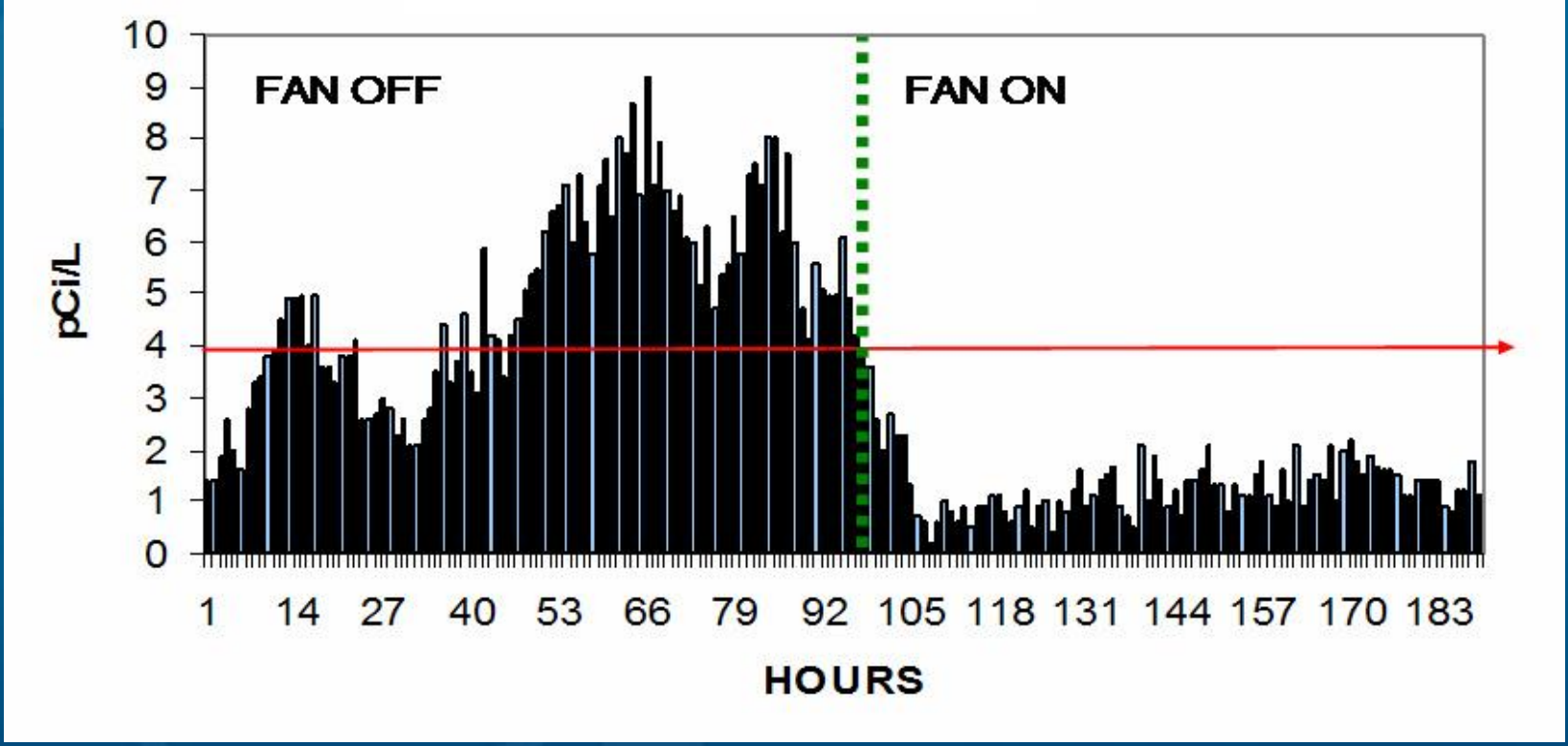
Baseline Questionnaire Results, cont'd



Environmental Testing

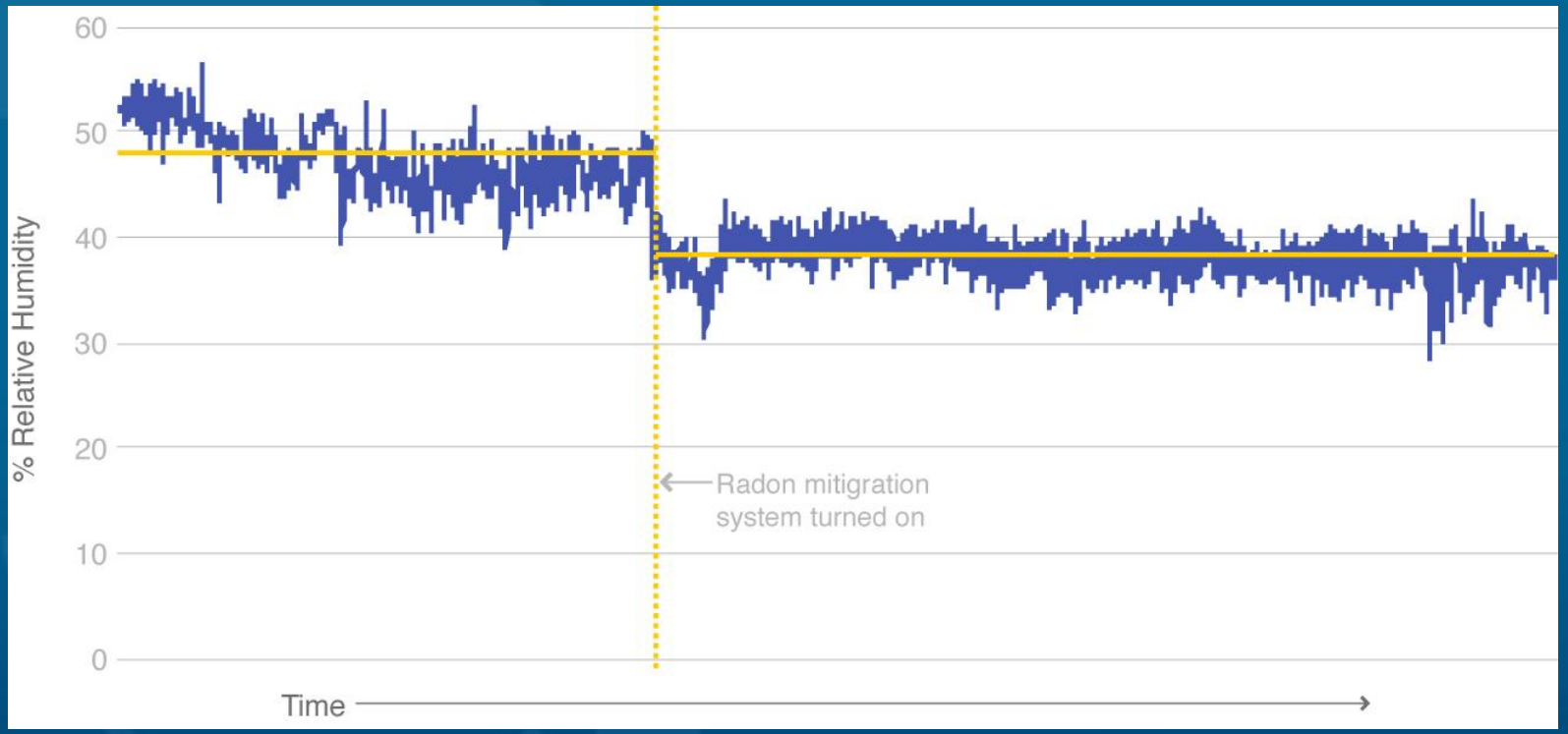
- Temperature and Relative Humidity
- Carbon Dioxide Measurements
- Radon: Short-term and long-term
- Total Volatile Organic Compounds (TVOCs)

Radon Mitigation



CSBR, 2008

Radon Mitigation Impact on Moisture



CSBR, 2008

Ventilation Testing

Ventilation System	Before Renovation	After Renovation	Comparison to Design Standard
Fresh Air Supply	None (bldg leakage only)	21-27 cfm	70% (ASHRAE 62.2)
Kitchen Exhaust	Yes (low flow rate unknown)	80 cfm (160 cfm fans specified)	100 cfm (ASHRAE 62.2)
Bath Exhaust	Yes (low flow rate unknown)	66 cfm (80 cfm fans specified)	50 cfm (ASHRAE 62.2
Building Envelop Leakage	Very High (Drafty Conditions)	0.38 cfm/ft^2 @ 50 Pa	0.24 cfm/ft^2 @ 50 Pa (MN SF)
Duct Leakage	Very High	71% @ 25 Pa	6 cfm/100ft^2
Duct Return Air Flow	Very Low	345 cfm	Within ± 10% of mfg spec

Summary of Interim Results

- Radon testing indicated need for mitigation, currently ongoing
- Noticeable improvements in child and adult health, comfort, safety and ease of cleaning
- Ventilation measurements show fresh air supply, duct sealing and need for improved exhaust ventilation in kitchens and bathrooms-corrective actions completed

Summary of Final Results

- Large and statistically significant improvements in general health, chronic bronchitis, hay fever, sinusitis, and asthma ($p<0.05$).
- Improvements ins hypertension among adults ($p=0.083$).
- Improvements in children's general health, children's respiratory allergies, children's ear infections, comfort, safety and ease of housecleaning.

Conclusions

- Low-income housing can be renovated using Green and Healthy Homes principles that promote energy conservation, sustainability and public health and safety.
- Ventilation and environmental testing help ensure that building renovation design performs as intended.
- Collaboration of housing, health and environmental professionals is essential.

Contact Information

Rebecca Morley

Executive Director

National Center for Healthy Housing

Columbia, MD

443.539.4159

rmorley@nchh.org

www.nchh.org