The October 2013 National Summit on OTC Sleep Aids and Sleep Health in Older Adults will be a full-day conference in Washington, DC. The Summit is intended to raise understanding of issues and risks related to OTC sleep aid use in older adults, and frame future efforts to address barriers affecting health care professionals, older adults, and caregivers. Stakeholders convening for the Summit draw from the public and private sectors; trade, professional, and advocacy organizations; and academia. Thought leaders with varied interests, experience, and expertise in OTC sleep aids and sleep health in older adults will be participating. The Summit is an effort of The Gerontological Society of America (GSA) and supported by Pfizer.

Objectives of the 2013 National Summit on OTC Sleep Aids and Sleep Health in Older Adults

- Increase understanding of sleep health and OTC sleep aid use in older adults (ages 65 years and older).
- Identify opportunities for improving understanding among health care practitioners, consumers, and caregivers regarding use of OTC sleep aids in older adults.
- Enable networking to create new connections and deepen existing relationships with individuals having a common interest in older adult sleep health and sleep aid use.

WEDNESDAY, OCTOBER 16, 2013

6:00 PM–8:00 PM
Registration and Networking Reception
Grand Hyatt—Cabin John Room

THURSDAY, OCTOBER 17, 2013

7:00 AM–8:00 AM
Registration and Breakfast
Grand Hyatt— Wilson Room

8:00 AM–8:30 AM
Welcome and Why We Are Here
Grand Hyatt—Constitution Rooms D/E
James C. Appleby, RPh, MPH, Executive Director and CEO
The Gerontological Society of America

Annette Schmidt, Senior Director of Strategic Alliances and Business Development
The Gerontological Society of America
8:30 AM–9:45 AM  
**Introduction of the Workgroup, Stakeholders, and the Goals for the Day**  
Steven M. Albert, PhD, *Workgroup Chairperson*  
Professor and Chair, Department of Behavioral and Community Health Sciences  
Graduate School of Public Health, University of Pittsburgh

9:45 AM–11:00 AM  
**Uncovering Stakeholder Experience and Perception Regarding OTC Sleep Aids and Sleep Health in Older Adults**  
Facilitator: Judy Klein

Participants will work in small groups to kick-start engagement in discussions and networking by using “investigative journalism” techniques to address the following questions:

- What are 3 to 5 key reasons or benefits relevant to you or your organization for improving sleep health in older adults?
- What do you believe to be the key issues older adults face on OTC sleep aid use?
- What are the greatest barriers you face in your organization to support improved OTC sleep aid use in older adults?
- What are 3 to 5 key ways you or your organization could contribute to achieve safe use of OTC sleep aids in older adults?

11:00 AM–11:15 AM  
**Wiggle Break**

11:15 AM–12:30 PM  
**State of Knowledge About Sleep Health in Older Adults**  
Speaker: Phyllis Zee, MD, PhD  
Professor of Neurology, Neurobiology, and Physiology  
Director, Sleep Disorders Center  
Northwestern University

Roundtable groups will discuss questions posed by Dr. Zee and share their top 1 to 2 themes and/or surprises uncovered.

12:30 PM–1:00 PM  
**Networking Lunch**  
*Grand Hyatt—Wilson Room*

1:00 PM–2:00 PM  
**State of Knowledge About OTC Sleep Aid Use by Older Adults**  
Speaker: Thomas Roth, PhD  
Director of Research and Division Head  
Sleep Disorders and Research Center  
Henry Ford Health System

Roundtable groups will discuss questions posed by Dr. Roth and share their top 1 to 2 themes and/or surprises uncovered.

2:00 PM–3:00 PM  
**Call to Action to Improve Safe Use of OTC Sleep Aids—Now and in the Future**  
Moderator: Steven M. Albert, PhD, *Workgroup Chairperson*  
Panel: James A. Owen, PharmD, BCPS; Deborah A. DiGilio, MPH; Joan Enstam Baird, PharmD, CGP, FASCP

Lively, moderated discussion among panelists representing varied perspectives; includes time for participants to pose thought-provoking questions to panelists.
3:00 PM–3:15 PM  Wiggle Break

3:15 PM–4:45 PM  Prioritize Topics for Future Emphasis  
Facilitator: Judy Klein

Participants break out into small groups to develop proposals (posters) for improving older adult sleep health and use of sleep aids. Led by Panel Discussants, Workgroup, and Facilitators.

4:45 PM  Closing Remarks: Reflections of the Day and Next Steps

5:00 PM  Adjournment
OTC Sleep Aids and Sleep Health in Older Adults

Research is Needed to Better Understand and Promote Safe and Effective Use

Welcome

James C. Appleby, RPh, MPH, Executive Director and CEO
1 out of every 9 Americans is 65 or older

- Boomers span 18 years — born from 1/1/1946 to 12/31/1964
  - Oldest turned 65 on January 1, 2011
  - Youngest boomers are 49

- More 65+ Americans than the populations of New York, London, and Moscow — combined
  - Living longer
  - More racial/ethnic diversity

- 7,000 to 10,000 people turning 65 every day for the next 16 years

US Bureau of the Census 2008 population estimates.

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The Gerontological Society of America

- Oldest, largest national/international professional membership organization
  - 5,600 interdisciplinary members touching all facets of aging

- Mission
  - Promote multi- and interdisciplinary research in aging
  - Translate and disseminate research findings
  - Promote/advocate for education/awareness on aging across disciplines
  - Foster application of research into policy development

- Sections
  - Biological Sciences (BS)
  - Health Sciences (HS)
  - Behavioral and Social Sciences (BSS)
  - Social Research, Policy, and Practice (SRPP)
The Gerontological Society of America

• **Our vision:**
  – *To be recognized as the preferred, trusted, credible partner for our research, knowledge, and unique collaborations across all disciplines leading to important innovative solutions in the field of aging*

• **Our focus:**
  – *Advancing innovation in aging to identify solutions that address unmet needs through our credible, trusted, respected members, affiliates, offerings, and collaborations*

International Membership

• Members from 45 countries; in addition to the United States, top countries include:

  - Australia
  - Brazil
  - Canada
  - China
  - Germany
  - Hong Kong
  - Israel
  - Italy
  - Japan
  - Netherlands
  - South Korea
  - Sweden
  - Taiwan
  - United Kingdom
GSA and Affiliates

- Oldest/largest international, interdisciplinary scientific organization in aging

- Association for Gerontology in Higher Education
  - Academic institutions with programs in gerontology and/or geriatrics

- National Academy on an Aging Society
  - Non-partisan policy institute

Stakeholder Organizations
Welcome

Annette Schmidt, Senior Director of Strategic Alliance & Business Development

Introduction of the Workgroup, Stakeholders, and the Goals for the Day

Steven M. Albert, PhD, Workgroup Chairperson
**OTC Sleep Aids and Sleep Health**

**Introductions**

- Name
- Organization
- Title/Role
- What are your goals for the day?

1 to 2 minutes, please

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**GSA National Summit on OTC Sleep Aids and Sleep Health in Older Adults**

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**Summit Agenda**

- **9:45 AM – 11:00 AM**
  - Uncovering Stakeholder Experience and Perception Regarding OTC Sleep Aids and Sleep Health in Older Adults

- **11:00 AM – 11:15 AM**
  - Wiggle Break

- **11:15 AM – 12:30 PM**
  - State of Knowledge About Sleep Health in Older Adults

- **12:30 PM – 1:00 PM**
  - Networking Lunch

- **1:00 PM – 2:00 PM**
  - State of Knowledge About OTC Sleep Aid Use by Older Adults

- **2:00 PM – 3:00 PM**
  - Call to Action to Improve Safe Use of OTC Sleep Aids—Now and in the Future

- **3:00 PM – 3:15 PM**
  - Wiggle Break

- **3:15 PM – 4:45 PM**
  - Prioritize Topics for Future Emphasis

- **4:45 PM – 5:00 PM**
  - Closing Remarks: Reflections of the Day and Next Steps

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**GSA National Summit on OTC Sleep Aids and Sleep Health in Older Adults**
OTC Medication Behavior

- Identify gaps in research required to improve OTC medication behaviors of older adults
- Assess factors that influence older adults' choice of OTC medications, e.g., health literacy, vision, cognitive strategies, packaging
- Examine contexts of OTC use: role of clinicians and lay caregivers
- Identify emerging technologies that may support optimal OTC medication practices

42% of older adults use OTC drugs regularly (Qato et al 2008)

The Health Literacy Task of OTC Use

- Recognize Symptom(s)
- Self-Select OTC Product(s)
- Know Proper Dosing
- Concomitant Use Warnings
- Know When to Stop
- Know Active Ingredient(s)
Can you take these products together?

- Acetaminophen 650 mg
- Acetaminophen 500 mg
- Acetaminophen 500 mg
- Acetaminophen 325 mg
- Acetaminophen 250 mg
- Acetaminophen 250 mg
- Acetaminophen 500 mg
- Acetaminophen 500 mg

Key Problem in OTC Behavior

**Unintentional Misuse Among Older Adults**

- 24% take more than recommended maximum dose for OTC product (Wolf et al 2012)
- 46% of adults misuse OTC products by concomitant use (Wolf et al 2012)
Sleep and OTC Behaviors

- 44% of older adults experience disturbed sleep at least a few nights each week (National Sleep Foundation 2013)
- 23% report taking sleep medications in past 4 weeks (NHANES 2013)
- 15% to 18% use OTC sleep aid; 40% concurrently taking 1+ anticholinergic medication (Kantar 2013)

Sleep Diary: Text

GSA National Summit on OTC Sleep Aids and Sleep Health in Older Adults

Courtesy, Anne Germaine
Sleep Diary: Graphic

Sleep Latency

Meta-Analysis, 21 Studies

Pharmacotherapy and Behavioral Therapy for Persistent Insomnia

Sleep Quality

To Ensure Safe and Effective Use of OTC Sleep Aids...

- What do we need to know about older adults’ actual use of OTC sleep aids?
- What do health care providers need to do?
- How should we educate consumers?
- How can we track OTC use in clinical practice and retail pharmacies?
State of Knowledge About Sleep Health in Older Adults

Phyllis Zee, MD, PhD

Why Is Sleep Important?

- 50-70 million Americans have a chronic sleep disorder (IOM 2006)
- 28% of adults report frequent insufficient sleep; 4.7% report falling asleep driving in the past 30 days (CDC 2008, 2010)
- Sleep disorders and deprivation are associated with many deleterious health consequences (IOM 2006)
- Annual direct (medical) and indirect (accidents, lost productivity, etc.) costs total hundreds of billions of dollars (IOM 2006)
Sleep, Circadian Rhythms, and Health

Sleep disorders
- Insomnia
- Sleep apnea
- Restless legs
- Narcolepsy

Aging
- Circadian disruption
- Behavioral lifestyle
- Work schedules
- Physical activity level

Genetic predisposition

Sleep Deficiency
Circadian Dysfunction

Appetite
Inflammation
Metabolism
Heart, lung functions

Health

Safety and Productivity
Cognitive performance

Effects of Aging on Sleep

Effects of Sleep (Poor) on Aging


GSA National Summit on OTC Sleep Aids and Sleep Health in Older Adults
**Similarities Between Sleep Loss and Aging**

**Function**
- Glucose tolerance
- Insulin sensitivity
- C-reactive protein
- Cardiac sympathetic activity
- Plasma norepinephrine
- Evening cortisol levels
- Plasma TSH levels
- Plasma leptin levels
- Mood
- Vigilance
- Subjective alertness
- Cognitive function

**Sleep Loss**

**Aging**

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**Prevalence of Insomnia by Age Group**

Large-scale community survey of non-institutionalized American adults, ages 18 to 79 years old

Percent of Sleep Complaints in Older Adults

(n = 9,282; mean age 74 years)

- Waking Not Rested
- Waking Too Early
- Trouble Falling Asleep
- Daytime Napping
- Insomnia
- Nocturnal Waking
- Initiating/Maintenance


Duration of Insomnia in the National Comorbidity Survey Replication

n = 2,578

Prevalence Rates of Sleep Disturbances in Persons With Dementia and Their Family Caregivers

<table>
<thead>
<tr>
<th>Caregivers</th>
<th>68%</th>
</tr>
</thead>
<tbody>
<tr>
<td>McCurry and Turi</td>
<td></td>
</tr>
<tr>
<td>Pruchno and Potashnik</td>
<td>22–41%</td>
</tr>
<tr>
<td>Wilcox and King</td>
<td>67%</td>
</tr>
<tr>
<td>(women only)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Persons with Dementia</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpenter et al.</td>
<td>40%</td>
</tr>
<tr>
<td>Craig et al.</td>
<td>42–54%</td>
</tr>
<tr>
<td>Lyketsos et al.</td>
<td>20–27%</td>
</tr>
<tr>
<td>McCurry et al.</td>
<td>35%</td>
</tr>
<tr>
<td>Moran et al.</td>
<td>25%</td>
</tr>
<tr>
<td>Pang, et al.</td>
<td>35–54%</td>
</tr>
<tr>
<td>Rabins</td>
<td>33%</td>
</tr>
<tr>
<td>Ritchie</td>
<td>19–44%</td>
</tr>
<tr>
<td>Thommessen et al.</td>
<td>25%</td>
</tr>
</tbody>
</table>


Possible Underlying Causes of Sleep Disturbance and Insomnia Symptoms

Common Conditions ¹,²

- Altered Sleep Regulation & Circadian Rhythms ¹
- Medical, Neurologic, & Psychiatric Conditions ¹
- Psychosocial Factors ²

- Difficulty Initiating & Maintaining Sleep
- Sleep Loss
- Chronic Pain Pulmonary Disease
- Late-Life Stressors
- Depression
- SDB (Sleep Apnea)
- Restless Legs

Changes in Sleep With Age

- Meta-analysis of 65 sleep studies in healthy persons
  - 3,557 total subjects ages 5 to 102 years old
- Most age-related sleep changes occur in early and mid-years of human life span
- In healthy older adults:
  - Sleep remains relatively constant from age 60 to mid-90s
    - Except for sleep efficiency which decreases
    - Wake after sleep onset increases
    - Slow wave sleep decreases


Poor Health Impacts Prevalence of Insomnia in Older Adult Population

- Percentage of insomnia and any chronic complaint in the healthiest and all healthiest groups among subjects aged >65 years.

**Sleep Quality and Medical Conditions**

Self-Reported Questionnaire Data From 1,506 Community-Dwelling Adults
Ages 55 to 84 years

![Bar chart showing proportions of sleep quality across different numbers of medical conditions.]


**Sleep: A Marker of Physical and Mental Health**

- Odds ratio (OR) of physical or mental health (determined with SF-12) contributing to a sleep complaint

![Graphs showing the relationship between type of sleep complaint and physical/mental summary score.]


n = 1,613; age 65-100 years
All significant at P<0.001
Normal age-associated changes in sleep are NOT primarily responsible for increased prevalence of insomnia and other sleep disorders in older adults.

Highest contribution is physical and mental health.

### Health Condition Associated With…

<table>
<thead>
<tr>
<th>Sleep Duration</th>
<th>Insomnia</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension$^1$</td>
<td>Yes (≤ 6 hours)</td>
<td>Yes</td>
</tr>
<tr>
<td>Type 2 Diabetes$^2$</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Neuropsychological test performance$^3$</td>
<td>Yes (≤ 6 hours) 5/14 tests</td>
<td>No</td>
</tr>
<tr>
<td>Mortality$^4$</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cortisol$^5$</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>


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**Cognitive Decline and Insomnia in Older Adults**

* Adjusted for baseline cognitive function, age, race, education, income, and marital status

Impact of Insomnia on Quality of Life

Axes represent subscales of the SF-36. All P values < .05 (range .000-.023).


Days-Out-of-Role Associated With Insomnia and Comorbid Conditions in America Insomnia Survey

Association Between Sleep Quality and Survival

Survival as a function of sleep latency

- Sleep latencies >30 minutes: 2.14x greater mortality risk ($P = 0.005$)

Survival as a function of sleep efficiency

- Sleep efficiency <80%: 1.93x greater mortality risk ($P = 0.014$)

Electroencephalographic sleep assessments are controlled for age, sex, and baseline medical burden.


Sleep Difficulties in Older Adults: Under-recognized in Medical Practice

Summary

- Healthy aging is associated with changes in sleep and circadian rhythms, BUT does not explain the magnitude of sleep problems in aging.
- It is the pathological changes in circadian and sleep and co-morbid medical and psychiatric disorders that result in most sleep complaints in the older adult.
- Behavioral treatments, such as light and activity, can improve circadian and sleep function-cognition and health in older adults with and without dementia.

"Worried About Growing Old? Don't Lose Sleep Over It."

Successful Aging

Exercise

Diet

SLEEP
Questions for Discussion

• Identify the top 3 to 5 consequences of poor sleep health in the older adult populations you serve
• Which stakeholders (e.g., primary care physician, caregiver, others) are well-positioned to assist older adults improve their sleep health?
  – Why?
  – What role would they play?
State of Knowledge About OTC Sleep Aid Use by Older Adults

Thomas Roth, PhD

Types of Sleep Aids

- Prescription drugs
- Herbal supplements
- Alcohol
- OTC drugs
Indication

• Prescription hypnotics
  – Treatment of insomnia; no limitation on duration
• OTC agents
  – For occasional sleeplessness for 2 to 3 days

Herbal Supplements

• The FDA updated the laws governing the labeling of herbal supplements so consumers now can see labels that explain how herbs can influence different actions in the body
• However, herbal supplement labels still cannot say anything about treating specific medical conditions because herbal supplements are not subject to clinical trials or to the same manufacturing standards as prescription or OTC drugs
• Example labeling statement: “to promote regular sleep patterns”
US FDA Permitted OTC Sleep Aids

• Diphenhydramine
  – Nytol, Sominex, Tylenol PM, Excedrin PM, Advil PM, Unisom SleepGels, etc.
  – Very weak H1 antagonist; H1/M1 potency ratio low to moderate
  – Pregnancy Category B
  – 1 crossover study in 20 elderly patients with insomnia; decreased only awakenings vs placebo; AEs vs placebo: dry mouth (80% vs 65%), dizziness (25% vs 10%), and headache (20% vs 5%)


US FDA Permitted OTC Sleep Aids

• Doxylamine
  – Unisom SleepTabs, Equaline Sleep Aid, Good Sense Sleep Aid, etc.
  – Very weak H1 antagonist; H1/M1 potency ratio low to moderate
  – Pregnancy Category B
  – No published placebo-controlled trials
### TABLE 1: 2012 AOS Beers’ Criteria for Potentially Inappropriate Medication Use in Older Adults

<table>
<thead>
<tr>
<th>Organ System/Therapeutic Category/Drug(s)</th>
<th>Recommendations, Rational, and Quality of Evidence (OE &amp; Strength of Recommendation (SR))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticholinergics (excludes Tacrolimus)</td>
<td>Highly anticholinergic; clearance reduced with advanced age, and tolerance develops when used as hypnotic; increased risk of confusion, dry mouth, constipation, and other anticholinergic effects. Use of diphenhydramine in special situations such as acute treatment of severe allergic reactions may be appropriate. QE = High (Hydroxyzine and Promethazine), Moderate (All others); SR = Strong.</td>
</tr>
<tr>
<td>Anticholinergics (excludes Tacrolimus)</td>
<td>Not recommended for prevention of extrapyramidal symptoms with antipsychotics; are ineffective agents available for treatment of Parkinson disease. QE = Moderate; SR = Strong.</td>
</tr>
</tbody>
</table>

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OTC Medication Is Most Commonly Used Sleep Aid Among Non-Elderly Using Sleep Aids


General Population

Percent of Patients Using OTCs, Alcohol, or Both

GSA National Summit on OTC Sleep Aids and Sleep Health in Older Adults

Longest Period of OTC Sleep Aid Use in Non-Elderly Adults

GSA National Summit on OTC Sleep Aids and Sleep Health in Older Adults
Number of Days in Last Month

<table>
<thead>
<tr>
<th>Age</th>
<th>&lt;1</th>
<th>1-4</th>
<th>5-19</th>
<th>20+</th>
</tr>
</thead>
<tbody>
<tr>
<td>60+</td>
<td>9.1%</td>
<td>24.1%</td>
<td>31.2%</td>
<td>35.6%</td>
</tr>
<tr>
<td>65+</td>
<td>8.3%</td>
<td>24.7%</td>
<td>31.4%</td>
<td>35.6%</td>
</tr>
<tr>
<td>75+</td>
<td>7.4%</td>
<td>19.3%</td>
<td>31.6%</td>
<td>41.7%</td>
</tr>
</tbody>
</table>

Base: Experiencing sleep difficulties, reporting one or more symptoms of sleeplessness, and use OTC for sleep difficulties

NHWS US 2012: (SQ6) Thinking of the sleeplessness or difficulty sleeping that you experience, which of the following sleep problems or symptoms do you regularly experience?

NHWS US 2012: (HH10) Which of the following have you experienced in the past 12 months? <Sleep difficulties>

NHWS US 2012: (SD75) Do you use an over-the-counter or herbal products to treat your sleep condition?

NHWS US 2012: (SD90) How many days did you use the following product(s) in the past month?
Number of Times OTC Sleep Aid Used


Number of Times OTC and Rx Used

Diphenhydramine Pharmacokinetics and Age

<table>
<thead>
<tr>
<th></th>
<th>Elderly Adults</th>
<th>Young Adults</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>69.4 ± 4.3</td>
<td>31.5 ± 10.4</td>
<td>8.9 ± 1.7</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>71.0 ± 11.4</td>
<td>70.3 ± 9.9</td>
<td>31.6 ± 6.8</td>
</tr>
<tr>
<td>Dose (mg)</td>
<td>86.0 ± 7.3</td>
<td>87.9 ± 12.4</td>
<td>39.5 ± 8.4</td>
</tr>
<tr>
<td>Cmax (ng/mL)</td>
<td>188.4 ± 54.5</td>
<td>133.2 ± 37.6</td>
<td>81.8 ± 30.2</td>
</tr>
<tr>
<td>tmax (h)</td>
<td>1.7 ± 0.8</td>
<td>1.7 ± 1.0</td>
<td>1.3 ± 0.5</td>
</tr>
<tr>
<td>t1/2 (h)</td>
<td>13.5 ± 4.2</td>
<td>9.2 ± 2.5</td>
<td>5.4 ± 1.8</td>
</tr>
<tr>
<td>CI (mL/min/kg)</td>
<td>11.7 ± 3.1</td>
<td>23.3 ± 9.4</td>
<td>49.2 ± 22.8</td>
</tr>
<tr>
<td>Vd (L/kg)</td>
<td>10.2 ± 3.0</td>
<td>14.6 ± 4.0</td>
<td>17.9 ± 5.9</td>
</tr>
<tr>
<td>Vd (L/kg)</td>
<td>13.6 ± 6.3</td>
<td>17.4 ± 4.8</td>
<td>21.7 ± 6.6</td>
</tr>
<tr>
<td>AUC (ng/mL/h)</td>
<td>1902 ± 572</td>
<td>1031 ± 437</td>
<td>475 ± 137</td>
</tr>
<tr>
<td>MRT (h)</td>
<td>14.8 ± 2.8</td>
<td>11.3 ± 3.1</td>
<td>6.4 ± 1.6</td>
</tr>
</tbody>
</table>

* Mean ± standard deviation.

Table 1: Subject Characteristics and Diphenhydramine Pharmacokinetics

<table>
<thead>
<tr>
<th>Subject Characteristics</th>
<th>Young Men (n = 10)</th>
<th>Elderly Men (n = 7)</th>
<th>Young Women (n = 10)</th>
<th>Elderly Women (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>30.4 ± 5.8</td>
<td>66.3 ± 1.8</td>
<td>78.4 ± 2.4</td>
<td>76.1 ± 1.2</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>73.9 ± 2.2</td>
<td>71.0 ± 5.4</td>
<td>60.4 ± 8.7</td>
<td>69.2 ± 3.6</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>177.9 ± 1.3</td>
<td>176.0 ± 1.3</td>
<td>166.7 ± 2.2</td>
<td>169.9 ± 1.9</td>
</tr>
<tr>
<td>Cmax (mg/mL)</td>
<td>35.3 ± 4.2</td>
<td>32.4 ± 6.1</td>
<td>34.7 ± 5.9</td>
<td>28.7 ± 2.9</td>
</tr>
<tr>
<td>tmax (hrs after dose)</td>
<td>2.1 ± 0.4</td>
<td>2.3 ± 0.3</td>
<td>2.2 ± 0.2</td>
<td>2.7 ± 0.3</td>
</tr>
<tr>
<td>t1/2 (hrs)</td>
<td>4.1 ± 0.3</td>
<td>7.4 ± 3.0</td>
<td>4.4 ± 0.3</td>
<td>4.8 ± 3.0</td>
</tr>
<tr>
<td>Total AUC (mg·hr/mL)</td>
<td>192.5 ± 18.5</td>
<td>160.4 ± 21.8</td>
<td>270.2 ± 71.4</td>
<td>180.9 ± 16.8</td>
</tr>
<tr>
<td>Total clearance (ml/min/kg)</td>
<td>28.0 ± 2.8</td>
<td>35.3 ± 4.1</td>
<td>27.7 ± 4.1</td>
<td>32.8 ± 4.2</td>
</tr>
</tbody>
</table>

Values are presented as the mean ± standard error. Cmax: peak plasma concentration; tmax: time of Cmax; t1/2: elimination half-life; AUC: area under the plasma concentration-time curve.


Figure 1: Mean plasma diphenhydramine concentrations at corresponding times (A) in young (●) and elderly (○) men and (B) in young (●) and elderly (○) women.

### Pharmacokinetics Comparison Across Studies

#### Comparison of Pharmacokinetic Variables for Diphenhydramine Among Published Studies

<table>
<thead>
<tr>
<th>Reference</th>
<th>Vd (L/kg)*</th>
<th>Half-Life (hr)*</th>
<th>Clearance (mL/min/lb)*</th>
<th>Oral Bioavailability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albert, et al (N = 2)</td>
<td>—</td>
<td>5.6</td>
<td>—</td>
<td>0.50†</td>
</tr>
<tr>
<td>Carruthers, et al (N = 6)</td>
<td>3.29</td>
<td>3.3</td>
<td>11.2</td>
<td>0.43</td>
</tr>
<tr>
<td>Berliner, et al (N = 5)</td>
<td>4.17</td>
<td>4.1</td>
<td>12.1</td>
<td>0.61</td>
</tr>
<tr>
<td>Spector, et al†</td>
<td>8.04</td>
<td>9.3</td>
<td>9.8</td>
<td>—</td>
</tr>
<tr>
<td>Meredith, et al (N = 10)</td>
<td>4.54</td>
<td>8.4</td>
<td>6.2</td>
<td>0.72</td>
</tr>
</tbody>
</table>

*Kinetik variables after intravenous dosage. Vd = volume of distribution, N = number of subjects.

---

### 20 Agents With Greatest M1/H1 Binding Affinity Ratio That Cross BBB (Highest Ratio of M1/H1 Inhibition Constants)

<table>
<thead>
<tr>
<th>Agent</th>
<th>Approximate H1-M1 Binding Affinity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrilamine</td>
<td>130.00</td>
<td>Highly selective H1 antagonist available OTC for cold and menstrual symptoms</td>
</tr>
<tr>
<td>Miltecaprone</td>
<td>5000</td>
<td>Highly selective H1, was in insomnia development by Organon; now Merck owned</td>
</tr>
<tr>
<td>Methapyrilone</td>
<td>1800</td>
<td>Was in OTC sleep aids until caused liver cancer in rats with long-term use</td>
</tr>
<tr>
<td>Dimenhydrinate</td>
<td>700</td>
<td>S-isomer potent M2 antagonist; R isomer responsible for H1 antagonism</td>
</tr>
<tr>
<td>Hydroxyzine</td>
<td>590</td>
<td>Relatively low potency anti H1 with relatively low M1; probably dosed too high</td>
</tr>
<tr>
<td>Triazolam</td>
<td>550</td>
<td>Low potency anti H1 with minimal M1; most potent for NB, SHT2, SHT7 blockade</td>
</tr>
<tr>
<td>Doxepin</td>
<td>330</td>
<td>Highly selective H1; Somaxin recently received FDA insomnia indication for 3-6 mg</td>
</tr>
<tr>
<td>Triprolidene</td>
<td>230</td>
<td>Available OTC and often combined with cold medications, relatively H1 selective</td>
</tr>
<tr>
<td>Carbinoxamine</td>
<td>220</td>
<td>FDA approved for allergy, vasoconstrictor; mild urticaria, angioedema, low anti-M1</td>
</tr>
<tr>
<td>Triptolide</td>
<td>180</td>
<td>Relatively weak H1, very low M1 antagonist</td>
</tr>
<tr>
<td>Isoahdydyl</td>
<td>180</td>
<td>Very selective; H1 antagonist; available for allergy and ex topical antihistaminic</td>
</tr>
<tr>
<td>Pyrithiozone</td>
<td>170</td>
<td>Closely related to promethazine; Moderate selectivity</td>
</tr>
<tr>
<td>Chlorpheniramine</td>
<td>120</td>
<td>OTC anti-H1; relatively H1 selective, also delayed release, Pregnancy Cat B</td>
</tr>
<tr>
<td>Clemastine</td>
<td>62</td>
<td>OTC anti-H1; potent M1; moderate selectivity; long T1/2; Pregnancy Cat B</td>
</tr>
<tr>
<td>Alimemazine</td>
<td>53</td>
<td>Somewhat selective; not available in U.S.; antiurinary, anti-emetic, allergy, sedation</td>
</tr>
<tr>
<td>Dicyclomine</td>
<td>40</td>
<td>Weak H1 antagonist but no Ach blockade and minimal others; Pregnancy Cat B</td>
</tr>
<tr>
<td>Meclizine</td>
<td>25</td>
<td>Very weak H1; very low anti-Ach; used for vertigo/motion sickness</td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>24</td>
<td>Marketed in Europe for allergy; potent M1 blocker; also dopamine reuptake inhibitor</td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>20</td>
<td>Weak H1 antagonist but low Ach blockade and minimal others; Pregnancy Cat B</td>
</tr>
</tbody>
</table>


Diphenhydramine

100,000
10,000
1,000
10
1

1/Relative Selectivity x 10,000

H₁ 5HTT NET M₁ alpha₁

10 x Kᵦ for H₁


Efficacy of Diphenhydramine in Family Care

Efficacy of Diphenhydramine and Valerian

<table>
<thead>
<tr>
<th>Variable</th>
<th>Valerian-Hops</th>
<th>Group</th>
<th>Placebo</th>
<th>Diphenhydramine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sleep Latency, min</td>
<td>Sleep Latency, min</td>
<td>Sleep Latency, min</td>
<td></td>
</tr>
<tr>
<td>Sleep diary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>35.07 (25.79)</td>
<td>27.88 (20.96)</td>
<td>25.69 (13.73)</td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td>27.54 (25.02)</td>
<td>23.77 (21.49)</td>
<td>21.62 (12.87)</td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td>25.89 (28.10)</td>
<td>23.71 (21.19)</td>
<td>22.11 (13.83)</td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td>25.71 (25.48)</td>
<td>24.50 (17.90)</td>
<td>20.70 (13.80)</td>
<td></td>
</tr>
<tr>
<td>Polysomnography</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>19.48 (21.61)</td>
<td>36.04 (43.30)</td>
<td>17.77 (19.40)</td>
<td></td>
</tr>
<tr>
<td>Week 1</td>
<td>15.94 (17.69)</td>
<td>19.50 (29.25)</td>
<td>15.65 (22.64)</td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td>9.08 (4.93)</td>
<td>18.35 (22.82)</td>
<td>10.46 (9.57)</td>
<td></td>
</tr>
</tbody>
</table>

### Efficacy of Diphenhydramine and Valerian

<table>
<thead>
<tr>
<th></th>
<th>Valerian</th>
<th>Placebo</th>
<th>Diph 50 mg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Sleep Time (min)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sleep diary</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>392.91 (67.66)</td>
<td>384.46 (74.71)</td>
<td>389.99 (74.95)</td>
</tr>
<tr>
<td>Week 2</td>
<td>404.88 (67.14)</td>
<td>401.76 (78.35)</td>
<td>419.59 (60.62)</td>
</tr>
<tr>
<td>Week 4</td>
<td>418.82 (66.49)</td>
<td>405.75 (71.07)</td>
<td>399.96 (77.04)</td>
</tr>
<tr>
<td>Week 6</td>
<td>411.06 (73.62)</td>
<td>399.17 (76.74)</td>
<td>412.85 (82.10)</td>
</tr>
<tr>
<td><strong>Polysomnography</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>340.69 (88.29)</td>
<td>335.02 (61.17)</td>
<td>347.93 (82.73)</td>
</tr>
<tr>
<td>Week 1</td>
<td>373.73 (65.01)</td>
<td>362.69 (74.80)</td>
<td>375.21 (41.09)</td>
</tr>
<tr>
<td>Week 2</td>
<td>381.36 (65.95)</td>
<td>370.40 (45.49)</td>
<td>382.77 (49.21)</td>
</tr>
</tbody>
</table>


### Efficacy of Temazepam and Diphenhydramine in Elderly Adults With Sleep Problems

#### Table 3. Results of Morning Questionnaire

<table>
<thead>
<tr>
<th>QUESTION*</th>
<th>TEMAZEPAM</th>
<th>DPH</th>
<th>PLACEBO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (latency)</td>
<td>1.84†</td>
<td>2.20†</td>
<td>1.80</td>
</tr>
<tr>
<td>2 (duration)</td>
<td>1.74</td>
<td>2.15</td>
<td>1.87</td>
</tr>
<tr>
<td>3 (number of awakenings)</td>
<td>1.97</td>
<td>2.01</td>
<td>1.90</td>
</tr>
<tr>
<td>4 (time spent awake)</td>
<td>1.76</td>
<td>2.04</td>
<td>1.84</td>
</tr>
<tr>
<td>5 (overall evaluation)</td>
<td>1.91</td>
<td>2.14</td>
<td>1.83</td>
</tr>
<tr>
<td>6 (overall evaluation)</td>
<td>2.66</td>
<td>2.72</td>
<td>2.36</td>
</tr>
</tbody>
</table>

*See Table 1 for wording of questions and meaning of numerical results.
†Different from placebo p < 0.05.
DPH = diphenhydramine.

Safety in Elderly Adults

Table 4. Tests of Neurologic Function

<table>
<thead>
<tr>
<th>NEUROLOGIC TEST</th>
<th>TEMAZEPAM VS. PLACEBO</th>
<th>DPH VS. PLACEBO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word list</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Tapping board</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Cancellation test-time</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Cancellation test-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>omissions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digit span forward</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Digit span reverse</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Digit symbol substitution</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Plus sign indicates better score on test during week when this agent was administered.


Residual Sedation of Diphenhydramine 50 mg

Residual Effect of Diphenhydramine 50 mg on PET

FIGURE 1. Images of BPR of 11C-doxepin in the human brain. The BPR images taken from healthy male subjects (n = 8) using PET 12 hours after oral diphenhydramine 50 mg (left), bepotastine 10 mg (middle), or placebo (right) administration, and their MRI-T1 images (far right) are shown in the transaxial (top), coronal (middle), and sagittal (bottom) sections for each treatment. White circles indicate the ROIs. The brain image of each subject was transformed to fit stereotaxic brain space (spatial normalization) and was averaged across each treatment to generate the mean images. Note that treatment with diphenhydramine results in significantly lower BPRs than the other 2 treatments.


OTC Sleep Aids and Sleep Health

...And Miles to Go Before I Sleep
—Frost
Questions for Discussion

• How does this information compare with your understanding of the safety and effectiveness of OTC sleep aid use in older adults?
• What information gaps remain that prevent sufficient understanding regarding older adult use of OTC sleep aids?
• How do you believe this information should be used to assist older adults in making informed decisions about OTC sleep aid use?
Steven M. Albert, PhD, **Workgroup Chairperson**, is a Professor in the Graduate School of Public Health in the Department of Behavioral and Community Health Sciences at the University of Pittsburgh. He teaches courses on aging as a field of public health, the assessment of quality of life in health and aging, social dimensions of aging, evaluation, and a public health approach to long-term care. He is also the Chair for Research and Science.

Dr. Albert’s research centers on the assessment of health outcomes in aging and chronic disease, including physical and cognitive function, health service use, and the cost of care, quality of life, and clinical decision making. His recent efforts include investigation of mental health and clinical decisions at the end of life (National Institute of Mental Health) and a study of the cognitive and physical basis of independence in older people (National Institute on Aging). Dr. Albert’s current projects include a study of worksite health promotion, modeling of vaccine refusal across the lifespan, and public health surveillance of the end of life. He has completed research on attitudes toward health promotion in culturally insular communities, challenges in assessing quality of life in people with cognitive impairment, and cognitive factors in medication adherence. During 2010-2014, his group is leading a statewide comparative effectiveness trial of primary prevention of falling in old age (Centers for Disease Control and Prevention) and an investigation of functional trajectories at the end of life (National Institute of Nursing Research). His ongoing studies involve medication reviews among older adults in senior housing (The Pittsburgh Foundation) and use of nasal ventilation (ALS Foundation).

**Thomas Roth, PhD**, is the Director of the Sleep Disorders and Research Center at Henry Ford Health System in Detroit. His research primarily focuses on sleep processes, including research on sleep loss, sleep fragmentation, and deviation from sleep processes such as pharmacological effects and sleep pathologies. In addition to his position at Henry Ford Health System, Dr. Roth is a Clinical Professor of Psychiatry at the University of Michigan School of Medicine in Ann Arbor.

Dr. Roth has held numerous leadership positions within the field of sleep disorders. His is a past chairman of the National Center on Sleep Disorders Research Advisory Board at the National Institutes of Health. He also is a past president of the United States Sleep Research Society, the American Sleep Disorders Association, and the National Sleep Foundation.

Dr. Roth has published over 380 manuscripts, 13 edited volumes, 176 chapters, and 515 abstracts; he also is a past editor in chief of the journal *Sleep*. He received his doctoral degree from the University of Cincinnati in 1970.

**Michael Toscani, PharmD**, is the Fellowship Administrator for the Rutgers Institute for Pharmaceutical Industry Fellowships and Adjunct Clinical Professor at the Ernest Mario School of Pharmacy. Dr. Toscani is also President of Clinical Solutionz and Consulting Medical Director for KOL, LLC, which are private health care consulting companies. He has held senior management positions in the pharmaceutical, contract research, and health and disease management industries for more than 25 years, and he is a frequent national speaker and author in both the scientific and health care management areas. He currently serves on the editorial boards of the *Journal of Population Health Management* and *Specialty Pharmacy*, and was on the editorial boards of the *Journal of Clinical Outcomes Management, Journal of Clinical Research and Pharmacoepidemiology*, and the *Journal of Osteopathic Medicine*.

Dr. Toscani’s scholarly interests include clinical development of new pharmaceutical agents in multiple therapeutic areas; pharmaceutical industry trends; key opinion leader identification and management; the design and implementation of disease management initiatives focused on modifying patient behavior; value assessments; and outcomes studies evaluating the benefits of interventions on patient care. He is active in many charitable and nonprofit organizations. He currently serves as the president of the Central New Jersey Board of Advisors for the American Cancer Society and is the vice chairman of the Foundation Board for Thomas Edison State College. He is a past president and honorary board member of All Access Mental Health (AAMH), a community mental health treatment center in New Jersey. Dr. Toscani received his bachelor of science in pharmacy and doctor of pharmacy degrees from St. John’s University College of Pharmacy, and he completed a 2-year postdoctoral research and teaching fellowship in infectious diseases at Hartford Hospital.
Michael V. Vitiello, PhD, is Professor of Psychiatry and Behavioral Sciences, Gerontology and Geriatric Medicine, and Biobehavioral Nursing, and he is Co-Director of the Center for Research on the Management of Sleep Disturbances and Co-Director of the Northwest Geriatric Education Center at the University of Washington in Seattle. He is an internationally recognized expert in sleep, circadian rhythms, and sleep disorders in aging. His research efforts, funded by the National Institutes of Health, focus on the causes, consequences, and treatments of disturbed sleep, circadian rhythms, and cognition in older adults. He is the author of over 450 scientific articles, reviews, chapters, editorials, and abstracts.

Dr. Vitiello is a member of the Board of Directors and the Scientific Program, a co-chair of the Society of Behavioral Sleep Medicine, a member of the Governing Council of the World Sleep Federation, and serves as vice president of the International Sleep Science and Technology Association. He is a past president of both the Sleep Research Society and the Sleep Research Society Foundation, and past chair of the Sleep Disorders Research Advisory Board, National Institutes of Health. He has served as the Scientific Program chair of the Associated Professional Sleep Societies (American Academy of Sleep Medicine and Sleep Research Society), and on the Board of Directors of the National Sleep Foundation. He is a Fellow of The Gerontological Society of America and a founding member of the Society of Behavioral Sleep Medicine and the International College of Geriatric Psychoneuropharmacology. Dr. Vitiello is founding co-editor and editor in chief (for the Americas) of Sleep Medicine Reviews, and a member of the editorial boards of the Journal of the American Geriatrics Society and Sleep Medicine. He has previously served on the editorial boards of American Journal of Geriatric Psychiatry, Behavioral Sleep Medicine, Journal of Gerontology: Medical Sciences, Journal of Gerontology: Psychological Sciences, and Sleep.

Phyllis C. Zee, MD, PhD, is Professor of Neurology, Neurobiology, and Physiology at Northwestern University. She is also Director of the Sleep Disorders Center and the Accreditation Council for Graduate Medical Education–accredited sleep medicine fellowship training program and Associate Director of the Center for Sleep and Circadian Biology. She earned a doctoral degree in physiology and biophysics and a medical degree from the Chicago Medical School in Illinois. As a National Institutes of Health (NIH) postdoctoral fellow, she conducted basic science studies on the effects of age on circadian rhythms and sleep.

Dr. Zee’s career focus has been to translate basic and clinical science in sleep and circadian biology to the practice of neurology and sleep medicine. Her research investigates the effects of age on sleep and circadian rhythms, genetic regulation of circadian sleep disorders, and behavioral interventions to improve sleep and performance. Her current NIH-sponsored research projects include studies to examine the ability of exercise to improve sleep and health in older people with insomnia, phenotypic characterization and genetic analysis of circadian rhythm sleep disorders, relationship between sleep, metabolic and cardiovascular risk, and the effects of age on the neural response to sleep loss. Dr. Zee is active on committees and panels both locally and nationally. She has been on the editorial boards of several journals and is currently an associate editor for the journal Sleep. Dr. Zee also is on the Board of Directors of the Sleep Research Society, the National Sleep Foundation, and is the chair of the NIH Sleep Disorders Research Advisory Board.
Morris Lewis, MBA, is Senior Director of External Affairs at Pfizer Consumer Healthcare. He began his career at Pfizer, Inc. in 2003, and led Pfizer’s Medicare Part D commercial effort from 2003 to 2008. Thereafter, until joining Pfizer Consumer Health in 2010, Mr. Lewis led public affairs efforts across Pfizer’s branded prescription medications. Prior to joining Pfizer, he was involved for 10 years as a consultant to the pharmaceutical industry, primarily on the topics of managed care and disease management; he also spent a number of years in other health care industry positions. Mr. Lewis holds a master of business administration from the Wharton School of Business at the University of Pennsylvania and undergraduate degrees from Washington and Lee University.
Reactor Panel

Joan Enstam Baird, PharmD, CGP, FASCP, is the Director of Clinical Affairs for the American Society of Consultant Pharmacists (ASCP) in Alexandria, Virginia. She serves as a resource to ASCP members and staff on issues related to clinical practice and oversees all ASCP activities pertaining to clinical affairs.

Previously, Dr. Baird’s work in geriatric pharmaceutical care included consulting and dispensing for two national pharmaceutical services companies. She also has been a clinical pharmacy specialist for two state mental health facilities on the eastern shore of Maryland. Her administrative experience includes work as the program coordinator for the Mental Health Program at the University of Maryland Baltimore School of Pharmacy, where she developed and presented usage reports at the statewide Pharmacy and Therapeutics Committee meetings. These data were used to educate prescribers at the state psychiatric facilities about appropriate use of antipsychotic medications, with an emphasis on reducing polypharmacy through dosage optimization and stepwise prescribing regimens.

Dr. Baird has been an active member of ASCP since 2005. She has participated in the planning and execution of state conferences and other events for the Maryland Chapter of ASCP and has served as the chapter’s membership director. She has lectured on safe medication prescribing to geriatric patients to both nursing students and the general public, and has served as an adjunct faculty member of the University of Maryland Eastern Shore School of Pharmacy.

Deborah A. DiGilio, MPH, is the Director of the American Psychological Association Office on Aging. The office promotes the application of psychological science and practice to address the needs and support the strengths of older adults, their families, and caregivers. Her current efforts focus on increasing the availability of mental health services for older adults, building the psychology and aging workforce through expanded education and training opportunities, public education, and advocating for policies that promote positive aging and address the needs of older adults with mental and behavioral health disorders. Ms. DiGilio has worked in the health and aging field for over 30 years, including positions with
George Mason University, AARP, the American Public Health Association, and Kaiser Permanente of the Mid-Atlantic States. Ms. DiGilio is currently on the Board of Directors of the National Alliance for Caregiving and the Coordinating Council of the Eldercare Workforce Alliance, and she is a past chair of the National Coalition on Mental Health and Aging.

James A. Owen, PharmD, BCPS, is the Associate Vice President of Practice and Science Affairs at the American Pharmacists Association (APhA), the national professional society of pharmacists headquartered in Washington, DC. He manages APhA’s practice affairs activities including medication therapy management projects and services, directs activities and projects for the APhA Community Pharmacy Residency Program initiative, oversees activities for APhA’s Practice and Science Academies, and participates in activities associated with medication safety and quality improvement.

Prior to joining APhA, Dr. Owen was the Director of Clinical Services and Professional Development for Happy Harry’s Inc., a regional chain pharmacy organization based in Newark, Delaware, where he developed and initiated clinical service programs, directed activities for training of pharmacy staff, and provided community outreach. His background includes 17 years of experience in community pharmacy practice as a staff pharmacist, pharmacy manager, preceptor, and community pharmacy residency director. Dr. Owen continues to practice part-time as a health-system inpatient pharmacist.

He graduated from the Philadelphia College of Pharmacy and Science with a bachelor of science in pharmacy in 1990 and earned his doctor of pharmacy degree from the Massachusetts College of Pharmacy and Health Sciences in 2007. He is Board Certified in Pharmacotherapy by the Board of Pharmacy Specialties.
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Carly Bushong  
Meetings and Education Manager  

Judy Klein  
Facilitator  

Judie Lieu  
Senior Director of Innovation  

Annette Schmidt  
Senior Director of Strategic Alliance and Business Development  

Kim Wolfe  
Facilitator

The Gerontological Society of America