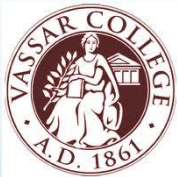




Breast Cancer Option's
2017 COMPLEMENTARY MEDICINE CONFERENCE

The Environment and Breast Cancer



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General Risks Factors Associated with Cancer

- **Genes** (primary, polygenic, epigenetic)
- **Lifestyle** (diet, exercise, BMI/obesity, alcohol intake, smoking history & exposure)
- **Reproductive history** (age at menarche, age at menopause, # full-term births, whether or not breastfed, etc.)
 - **Lifetime exposure to estrogens, especially estradiol**
 - **Also other endocrine factors (hormones)**

Other Risks Factors Associated with Breast Cancer

- **Environmental toxicants**
 - Radiation, including medical radiation
 - Known and recognized carcinogens
 - **Endocrine Disrupting Compounds (EDCs)**
- **Risk factors for disease do not act in isolation**

Caveats Important in Talking About Breast Cancer (or most cancers)

Breast cancer(s)

- **Not a singular disease**
 - Age
 - Menopausal status
 - Histopathology profile
 - Receptor (ER, PR) and oncogene (HER2) profile
- **Risk factors intersect**
 - Personal, social, community, ethnic history

Environmental chemicals in our bodies: Biomonitoring Studies

- 100s of chemical contaminants in our bodies
 - 216 linked to mammary tumors
 - 1000s more untested
-
- Crowd-sourced study by Silent Spring Institute – test your own body burden for \$299 <https://silentspring.org/detoxmeactionkit/>

Environmental chemicals in our bodies: Biomonitoring Studies

- Chemicals found in adults & children
- Also
 - Amniotic fluid
 - Cord blood
 - Newborns
 - Breast milk

SO WHAT????

Environmental chemicals in our bodies: Links with breast cancer

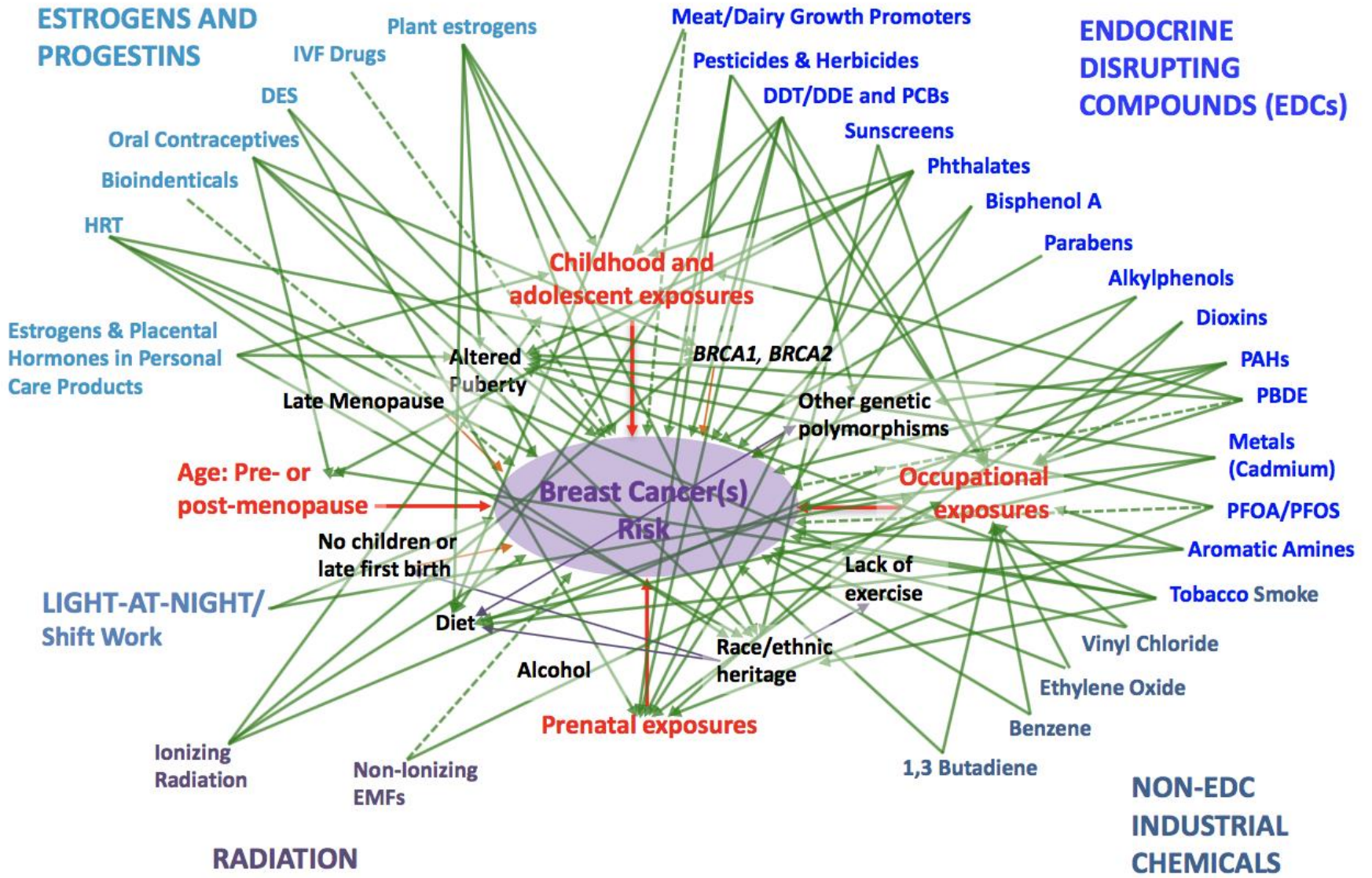
SOME

- Personal care products
- Plastics and plastic additives
- Pesticides and herbicides
- Industrial chemicals
- Metals
- Detergents and other cleaning products
- Hormone supplements
- Radiation (including medical radiation)

Endocrine Disrupting Compounds (EDC's)

An endocrine disrupting compound (EDC)
“is an exogenous chemical, or mixture of
chemicals, that interferes with any aspect of
hormone action.” *Endocrine Society, 2012*

Endocrine (hormonal) systems are absolutely
critical across the lifespan, as **organizers** during
early development and **activators** later on in life.



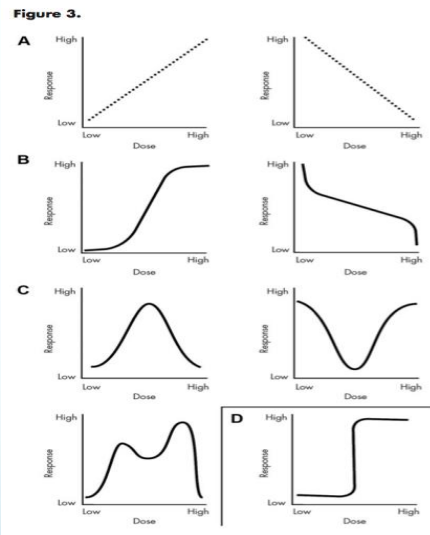
EDC Framework: Key themes

Timing of exposures



- Neonatal
- Early childhood
- Puberty, adolescence and early adulthood
- Pregnancy
- Lactation (mother and child)
- Post-menopausal

Low doses



Mixtures



Real life exposure mixtures interact

- Additively ($1+1=2$)
- Synergistically ($1+1=5$)
or
- Cancel one another out ($1+[-1]=0$)

Interactions



- Gene x environmental chemicals
- Reproductive history x environmental chemicals
- Lifestyle x environmental chemicals
- **Timing of exposure**
X dose

An example: **Diethylstilbestrol (DES)**

Women prescribed DES during pregnancy:

- 1950s-1972, to stave off spontaneous miscarriages & other problems of pregnancy
- Millions of women
- “Natural experiment”: Proof of concept
- **Mothers only exposed to DES during pregnancy**
- **Daughters only exposed to DES during gestation**



An example: **Diethylstilbestrol (DES)**

Women who took DES during pregnancy:

- Breast cancer (after age 40)

Daughters of women who took DES during pregnancy:

- Clear cell adenocarcoma
- Breast cancer
- Fertility problems



Granddaughters of women who took DES during pregnancy:

- (Breast cancer)

An example: **Diethylstilbestrol (DES)**

Classic EDC:

- Acts via estrogen (estradiol) pathways
- Changes DNA expression
 - Mainly through **epigenetic** changes
- Increases mammary cell proliferation (cell growth and division)

EDCs & **Plastics**



Exposures through leaching from food containers & wraps, chewing on plastics, contamination of air, water, dust

Alkylphenols: antioxidant stabilizers, surfactants

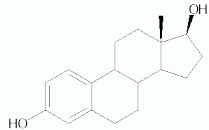
Phthalates: Plastic softeners, cosmetics additives

Polyvinylchloride (PVC): food packaging, credit cards, toys, building materials, etc

Bisphenol A (BPA)

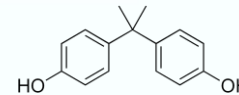
An example: Bisphenol A (BPA)

1938: BPA shown to mimic estrogen



Estradiol

BPA



2008: BPA found in 93% of U.S. adult human urine samples



Also: Amniotic fluid, fetal blood, newborns, milk

BPA and negative health outcomes: Laboratory studies

Unlike DES, most BPA research in animal (rodent) and cell culture studies

- **Early exposures and non-linear dose effects**
 - Morphological changes
 - Functional changes
- Alters cell culture proliferation, even with extracts from canned foods

BPA and negative health outcomes: Laboratory studies

Low doses of BPA → pregnant rats in their diet

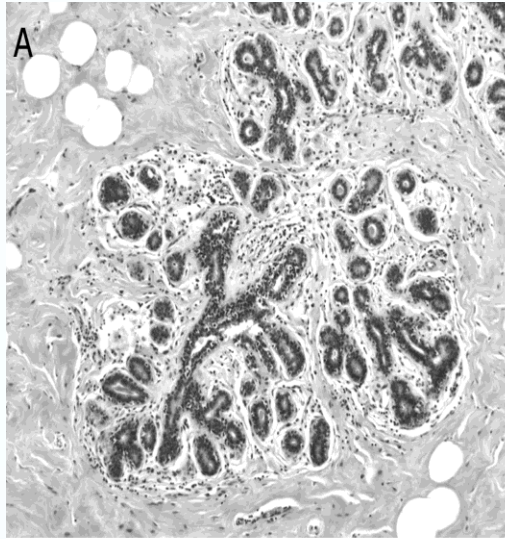
- Increased **mothers'** risk for developing mammary tumors.
- Increased **daughters'** risk for developing mammary tumors as adults.

Effect on daughters found when mothers were fed BPA

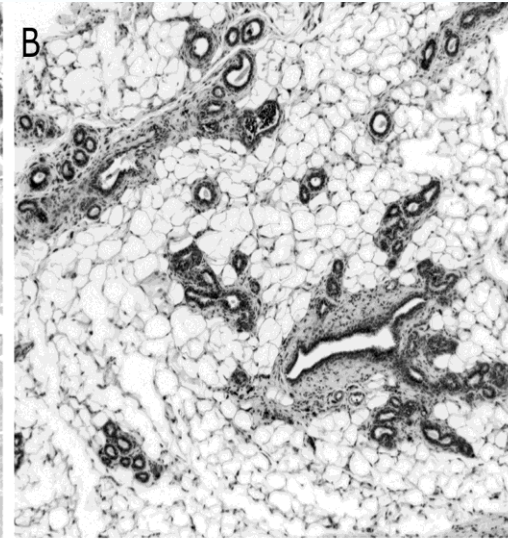
- Just during pregnancy.
- Just during lactation.

BPA and negative health outcomes: Laboratory studies

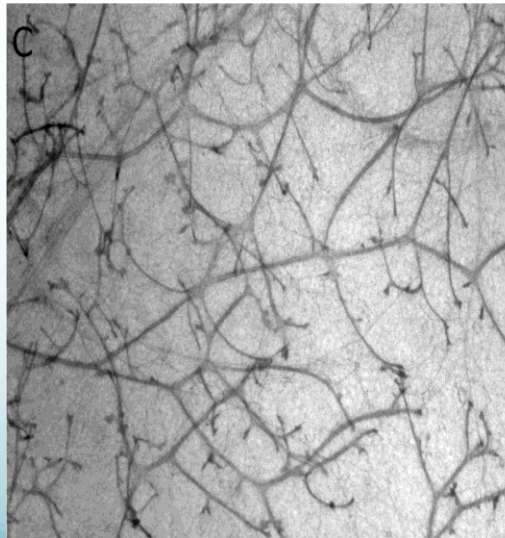
Adult human
mammary tissue



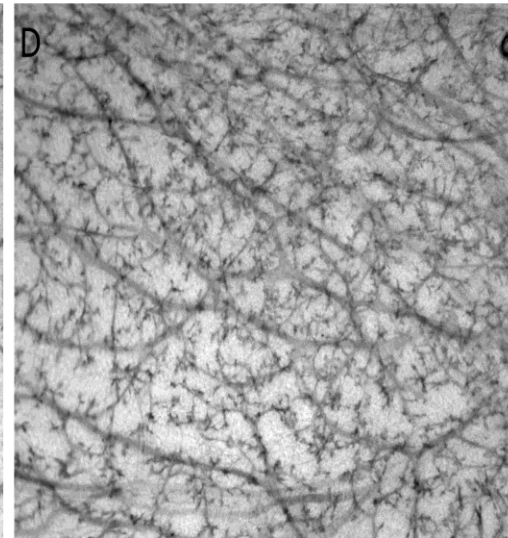
Adult rat
mammary tissue



Adult rat mammary
tissue with no
treatment during
gestation



Adult rat mammary
tissue with low dose
BPA treatment
during
gestation



BPA and DES: many similar effects

Acts through similar, overlapping mechanisms as does DES

For example:

- **Kass et al (2012):** Neonatal exposures → similar effects on
 - Altered mammary gland development (delayed differentiation)
 - During lactation, changes in milk
 - Yield
 - Composition

BPA and negative health outcomes: Laboratory studies

- Decreases efficacy of common chemo agents (vinblastin, doxyrubicin, cisplatin)

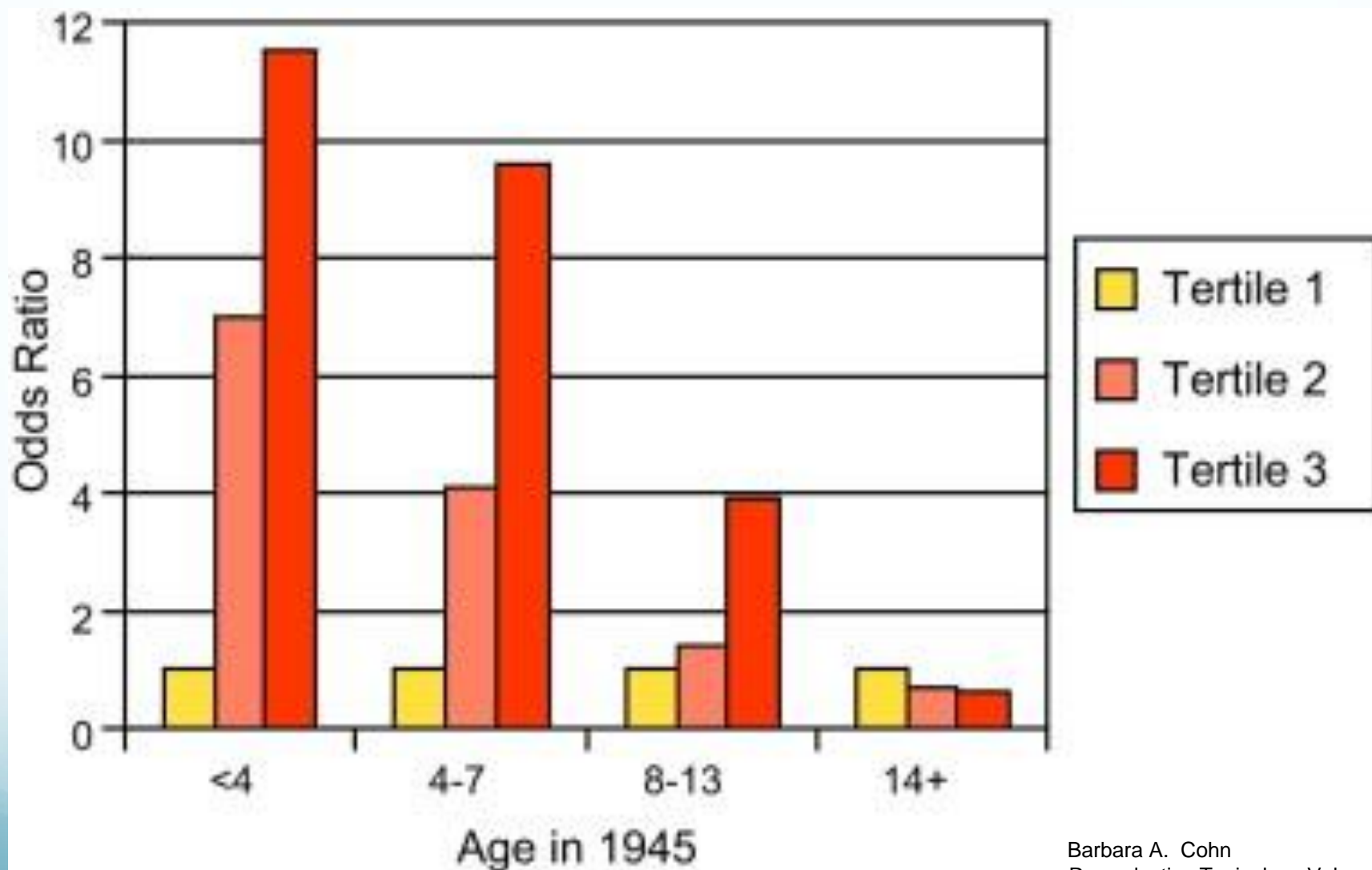
Another example: DDT

DDT: Organochlorine pesticide

- First synthesized 1874
- WWII – anti malaria and typhus
- 1950 – DDT hormone disruptor in roosters
- 1950's – local, ubiquitous insecticide
- 1962 – Rachel Carson's *Silent Spring*
- 1968 – DDT estrogenic in mammals
- 1972 – DDT agricultural restriction by EPA

DDT: Age of exposure and breast cancer risk

(Cohn, 2011)



Another example: Soy Derivatives



Soy and soy derivatives

- Protective
- Epidemiological and animal studies
- Timing of exposures and doses
- Dietary form matters; ethnic framing

Prevention

- **Primary vs. secondary prevention**
- **Goal: cure for cancer or prevention of cancer?**

Tips for Health and Beauty

Simple is best:

- Fewer products
- Avoid fragrances

Be careful about 'organic' or 'natural' claims

- Read labels

Avoid products with chemicals including:

- Parabens, phthalates, nonylphenol, triclosan
- Hormones including placental hormones
- Toluene, formaldehyde, petroleum distillate
- PEG, DEA, TEA, DMDM etc. !!

Tips for Home

Eat organic/pesticide free and kick the can

Minimize use of plastics, especially in the kitchen

- Use stainless steel or pyrex
- Don't microwave in plastic

Chose safer cleaning products

- Check for full disclosure on ingredients
- Make simple cleaners (vinegar, baking soda ...)

Stay away from non-stick pans: use oil and elbow grease with stainless steel, cast iron or ceramic!

Tips for Home

Whether you are a shift worker or not, minimize your exposure to light while you sleep.

Tips for Out and About

Check ingredients on sunscreens:

- Best choices may be zinc oxide or non-nanoized titanium oxide
- Avoid 4-MBC, OMC, HMS and oxybenzone

Minimize use of chemicals on your lawn and in your garden

Wash hands regularly, with simple soap and water. Avoid products containing anti-bacterials

Tips for Future Health

**Share this information with
your children and
grandchildren.**

Simplest is often the best!

THANK YOU!!!

**For more science, policy
and practical tips, go to
[http.bcpp.org](http://bcpp.org)**

**To read our recent publication on
the connection between breast
cancer and the environment, go to
<https://www.bcpp.org/resource/state-evidence-2017/>**