

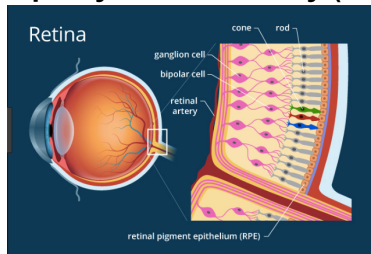
Health Outcomes and Populations

Foundations in Epidemiology I

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Retroental Fibroplasia (RLF) Now known as Retinopathy of Prematurity (ROP)



<http://www.allaboutvision.com/resources/retina.htm>

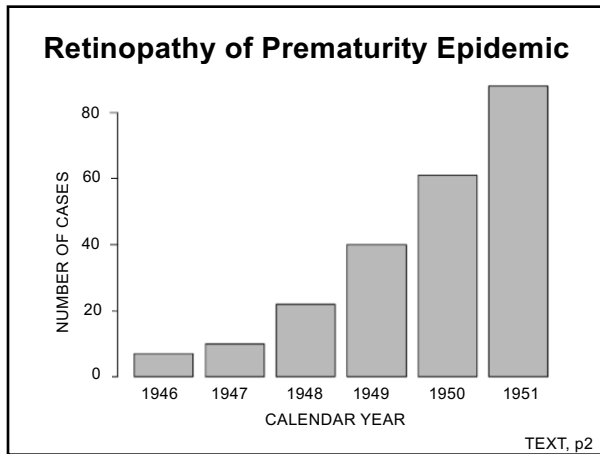
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Retinopathy of Prematurity Epidemic

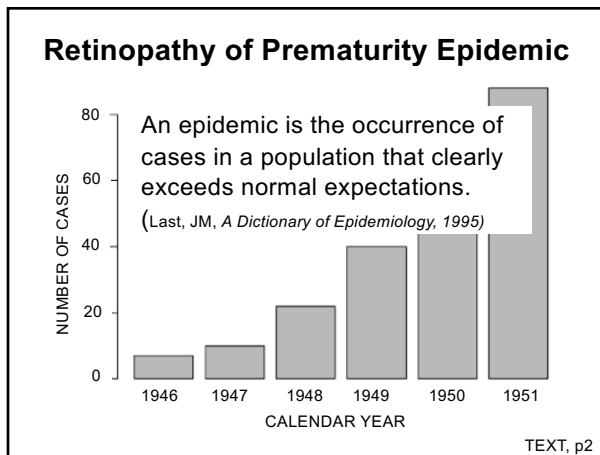
- Case Study of 3 month girl with vision loss (1941)
 - Dr. Stewart Clifford
 - Baby born premature
 - Retina damaged by hemorrhage and inflammation
- Case Series (1945)
 - Theodore Terry
 - 117 cases of ROP
 - 112 in babies born prematurely



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Is ROP Preventable?

- Case series implicated prematurity.
- Advances in premature infant care were concurrent with ROP epidemic
 - Hydration
 - Micronutrients
 - Incubators: temperature, humidity, oxygen
 - Infection
- Changing premature population → epidemic?

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Is epidemic a result of survivorship?

ROP Incidence by birth weight and year at 2 hospitals in Manchester, England (Jefferson, 1952; Table 1.1 in text)

Year	<3 lbs		3-3.5 lbs		3.5-4 lbs		>4 lbs	
	# Survived	ROP Cases	# Survived	ROP Cases	# Survived	ROP Cases	# Survived	ROP Cases
1947	4	1	11	0	31	0	72	0
1948	7	0	13	0	27	0	92	0
1949	9	2	18	0	30	0	50	0
1950	16	5	21	2	38	2	75	2
1951	13	12	22	12	30	9	50	9

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Is epidemic a result of survivorship?

ROP Incidence by birth weight and year at 2 hospitals in Manchester, England (Jefferson, 1952; Table 1.1 in text)

Proportion Survivors who Developed ROP				
Year	<3 lbs	3-3.5 lbs	3.5-4 lbs	>4 lbs
1947	0.25	0.00	0.00	0.00
1948	0.00	0.00	0.00	0.00
1949	0.22	0.00	0.00	0.00
1950	0.31	0.10	0.05	0.03
1951	0.92	0.55	0.30	0.18

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In Class Exercise I: 10 minutes

- Discuss in breakout rooms:
 - What trends do you see in the ROP data?
 - What are possible explanations for those trends?

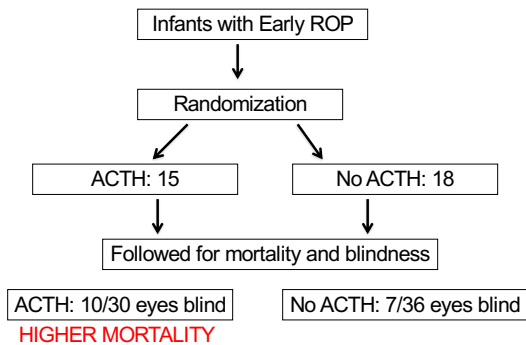
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Potential Cure - Adrenocorticotrophic Hormone

- Biological plausibility: premature infants have low ACTH, ACTH inhibits blood vessel proliferation.
- Study at New York Babies Hospital
 - Doctors treated 31 infants with early ROP symptoms with ACTH
 - 25 left hospital with normal eyes
 - 2 left blind, 2 lost vision in 1 eye, 2 had minor scarring in eye(s)
 - Major limitation of study?

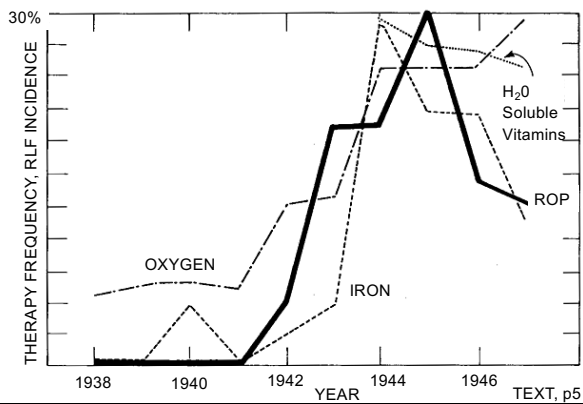
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Potential Cure – ACTH Randomized Trial (1951)



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Temporal Trends of ROP and Therapies



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Observational studies of supplemental oxygen use

- 1951, Kate Campbell
- 1951 Exline and Harrington
- Mixed results

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Supplemental Oxygen RCTs

- Randomized Controlled Trials
 - 1952, Arnall Patz
 - Randomized 65 babies < 3.5 lbs to high or moderate oxygen supplementation
 - High O₂ group: 61% developed ROP
 - Low O₂ group: 16% developed ROP
 - 1954, Kinsey
 - 350 babies < 3.3 lbs in 18 hospitals
 - Babies randomized 2 moderate O₂ to 1 high O₂
 - RLF Incidence 3 times higher for babies with High O₂
 - Mortality in 2 groups similar

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Bench Science Support

- Premature kitten model developed that closely mirrored premature human retina development
 - Supported role of excess O₂ in ROP

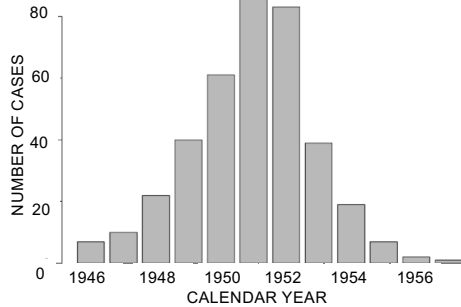


Image source: <https://www.piedmonteye.com>

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Public Health Implications

Research led to changes in clinical practice and American Academy of Pediatrics recommendations.



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ROP story take-aways



- Tracking disease frequency can help to detect epidemics and inform hypotheses about disease causes.
- Clinical interventions that make biologic sense may prove to be ineffective or even harmful in practice.
- Observational, experimental, and animal research are all important. They have different strengths and limitations. Epidemiologic research often involves collaborations between different disciplines.
- Epidemiologic discoveries can impact policy and health.

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What is epidemiology?

The study of the distribution and determinants of health-related states or events in populations, and the application of this study to control health problems.

John M. Last, Dictionary of Epidemiology

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What is epidemiology?

- Basic science of public health to:
 - Quantify occurrence of health outcomes and the relative importance of different causes of illness, disability, and death.
 - Discover factors that affect health outcomes.
 - Identify segments of the population that have the greatest risk for specific health outcomes.
 - Evaluate the effectiveness of different prevention and treatment strategies
 - Inform public policy

From CDC

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What is epidemiology?

- Fundamental concepts and tools
- Application of methods that considers
 - context
 - heterogeneity
 - dynamics
 - inference

From Schoenbach

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Case Definition

- How do we define a disease/condition?
 - Can be study-specific
 - Study case definition may differ from the clinical case definition

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In Class Exercise II

Study Aim: To test the hypothesis that the risk of developing an upper respiratory infection (URI or "cold") following an airline flight is greater if the airliner recirculates cabin air rather than using fresh air from outside the plane to ventilate the cabin.

Methods: 1,501 passengers recruited who were about to fly from San Francisco to Denver. Each person classified according to whether his/her aircraft used fresh or re-circulated air. Information obtained to contact participants after 5-7 days to determine new URI development. (Weiss & Koepsell, Chap.2, Q1)

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Which of the following would be suitable features of a practical case definition for this study? (via Zoom Quiz)

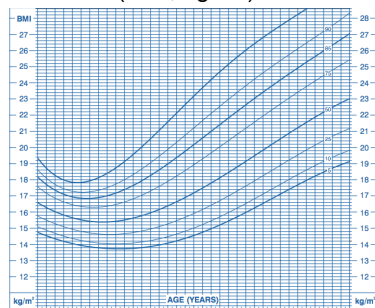
- Self-report of a cold
- Self-report of a cold, but with certain specific symptoms required to be present (e.g., self-report of a cold with at least symptoms A and B)
- Any observed specific combinations of self-reported cold symptoms (e.g. symptoms A+B+C, or symptoms D+E, etc.)
- Visited medical professional for symptoms that were diagnosed as a URI
- Blood test positive for recent exposure to at least one common pathogen known to cause URIs

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Case Definition for Obesity

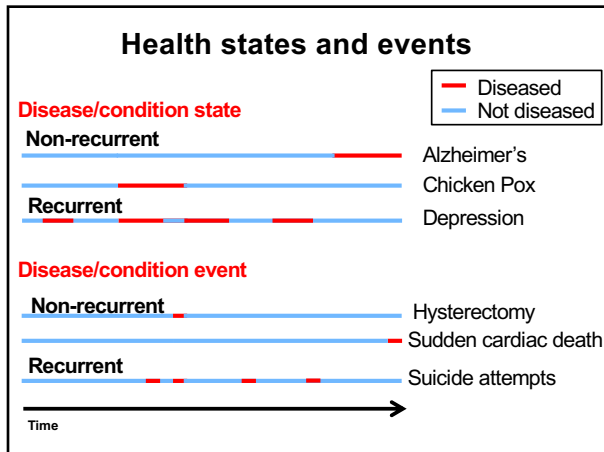
- In adults, body mass index (BMI, kg/m^2) ≥ 30
- In children, BMI percentile ≥ 95

CDC
BMI %iles
for Boys 2-
20 years
old



Published May 20, 2000 (revised 10/16/05)
SOURCE: Developed by the National Center for Health Statistics in collaboration with
the National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP).
http://www.cdc.gov/growthcharts

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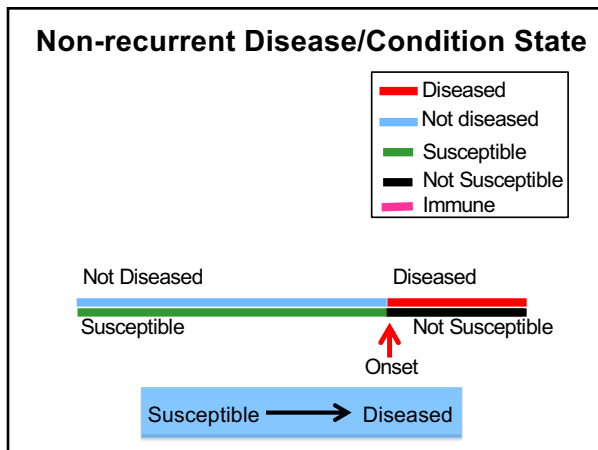
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Susceptibility

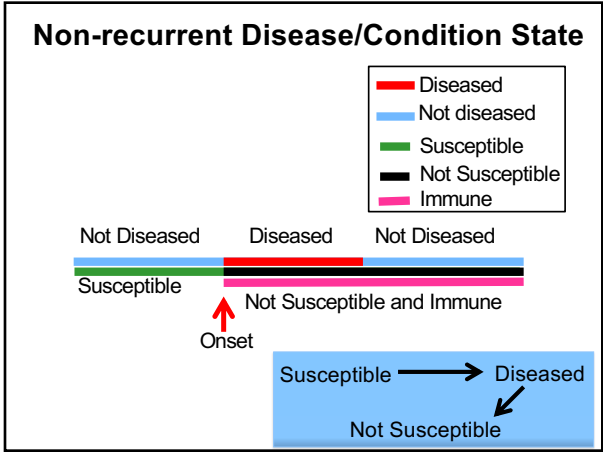
- **At risk:** It is possible to develop a disease during a time period of interest.
- **Not at risk:** There is no chance that the disease will occur during a time period of interest.

Common reasons for being not at risk	Example
The person already has the disease	Someone who has Alzheimer's Disease cannot develop it again
The person was never biologically capable of developing the disease	Men can't develop uterine cancer;
The person is currently biologically incapable of developing the disease	A woman with a hysterectomy can't develop uterine cancer. A person who has had measles is usually immune to a new infection.

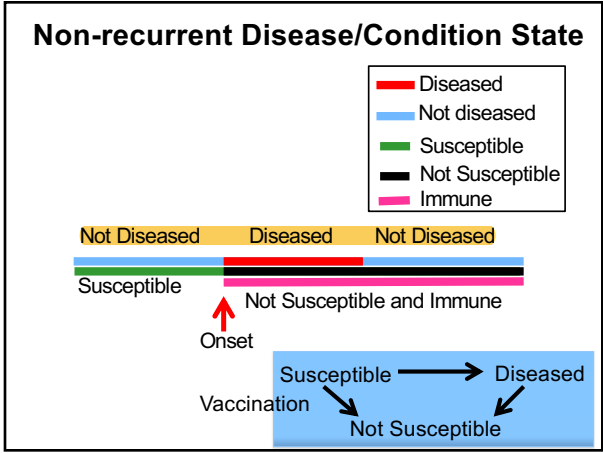
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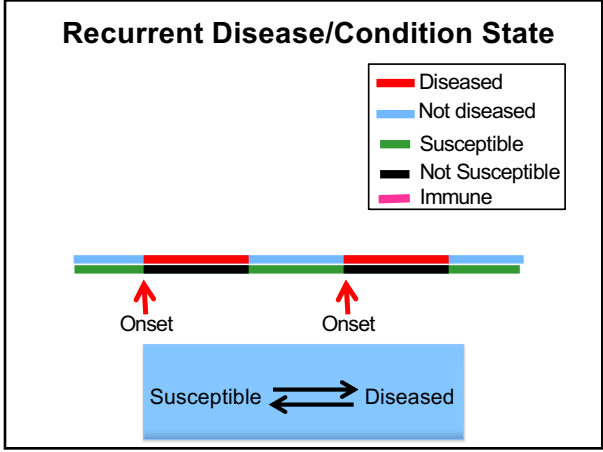


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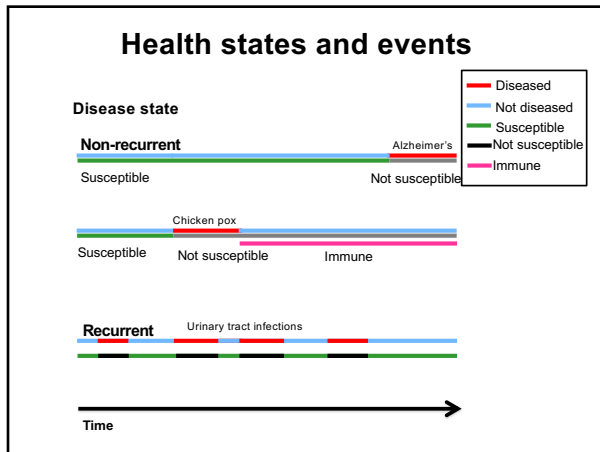


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Text



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In Class Exercise III:

Complete exercises III and IV in breakout rooms: 10 minutes

Disease State/Event	Recurrent?	Susceptible/ At Risk Population
Gestational Diabetes		
Prostate Cancer		
Teen Suicide		
Any adverse event during coronary bypass surgery		
Measles		

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In Class Exercise IV: Match

A. Susceptible → Diseased

B.

Susceptible → Diseased

↙ Non-susceptible ↘

C. Susceptible ↔ Diseased

D.

Susceptible → Diseased

↙ Non-susceptible ↘

1. Coronary Heart Disease

3. Bone Fracture

5. Ruptured Appendix

2. Depression

4. Miscarriage

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Defining populations

- Epidemiologic research seeks to identify all cases of disease in a defined population at risk
 - Person
 - Age
 - Gender
 - Membership in a predefined group
 - Place
 - Church picnic
 - State of NH
 - Time
 - Between 2010 and 2014

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Defining populations

- Examples:
 - Attendees at a church picnic
 - Current Dartmouth employees
 - Members of a health maintenance organization between 1992 and 2002
 - Women with intact ovaries, ages 35-74

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Defined populations observed over time

Closed or Fixed population

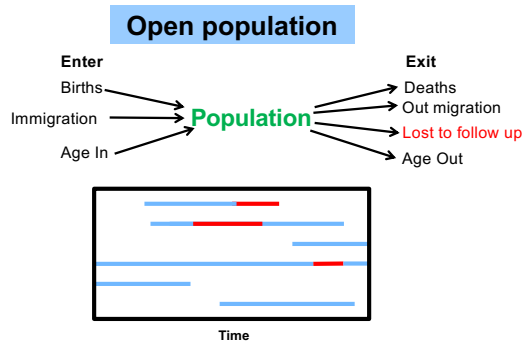


Time
All participants enroll at same time (calendar or study time) and everyone is followed for whole study.

Examples:
*Foodborne illness outbreak
*Clinical trial with complete follow-up

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Defined populations observed over time



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In Class Exercise V (via Zoom poll)

Classify each of the populations as open or closed

- Students enrolled in this Epidemiology class monitored for their Epidemiology knowledge over the course of the term.
- Dartmouth college Facilities and Operations employees monitored in 2016 for workplace injuries.
- Dartmouth College graduating class of 2016, tracked for death from any cause from graduation day for 20 years (assume all deaths can be ascertained)
- All women who gave birth at DHMC between 2010-2015, monitored for occurrence of a fatal delivery complication.

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