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Occupational Health

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Section A

Introduction to Occupational Health

Case 1

- You are asked by the Governor's Development Office to write a report on the public health implications of locating a new polyurethane foam insulation manufacturing plant in a suburban community in the state
- What do you need to know before you can write your report?
- What do you recommend?

Case 2

- A 37-year-old office worker presents complaining of eye and nose irritation, hoarseness, and shortness of breath
- There is no significant past medical history; the symptoms started after recent renovation of the offices at work, involving paints, glues, and new carpets
- What caused this?
- Can she continue to work?

Case 3

- Your employee has been arriving late to work for the past few weeks
- He explains that he has been having “problems” and is on medication
- You discuss a plan, but the tardiness, up to 60–90 minutes every day, continues

Case 3

- When you next meet with the employee, he asks that you make him an accommodation and allow a flexible work schedule and frequent breaks
- What do you do?

What Is Occupational Health? WHO, 1950

- The promotion and maintenance of the highest degree of physical, mental, and social well-being of workers in all occupations
- The prevention among workers of departures from health caused by their working conditions

What Is Occupational Health? WHO, 1950

- The placing and maintenance of the worker in an occupational environment adapted to the worker's physiological and psychological equipment
- The adaptation of work to the worker and of each worker to the job

Occupational Health: A Multidisciplinary Field

- Occupational medicine
- Occupational health nursing
- Industrial hygiene
- Safety science
- Ergonomics
- Employee assistance programs
- Health promotion/wellness programs
- Others

Brief Chronology

- 5th Century B.C.
  - Hippocrates—*Airs, Waters, and Places*—occupation and environment relevant to health
- 1556
  - Georgius Agricola—treatise on mining and metal industries
    - Miners short of breath, die prematurely
    - Describes one widow who outlived seven husbands who mined gold and silver in Erz Mountains (Czech border)

Brief Chronology

- Bernardino Ramazzini (Italy)—*De Moribus Artificum Diatriba* (*Diseases of Tradesmen*, 1713)
  - "When a doctor visits a working-class home, he should be content to sit on a three-legged stool if there isn't a gilded chair, and he should take time for his examination; and to the questions recommended by Hippocrates, he should add one more—'What is your occupation?'"

Two Important Reformers: Crystal Eastman

- Crystal Eastman, *Work Accidents and the Law,* 1906–1907
  - First systematic investigation of accidents occurring during one year in Allegheny County, Pennsylvania
  - 526 men killed by work accidents in county
    - 84% < 40 years old
    - 58% < 30 years of age

Photo source: http://www.ci.elmira.ny.us/history/pics/eastman_aclu.jpg.

Two Important Reformers: Alice Hamilton

- Photo: www.nlm.nih.gov/.../ img/portraits/137.jpg

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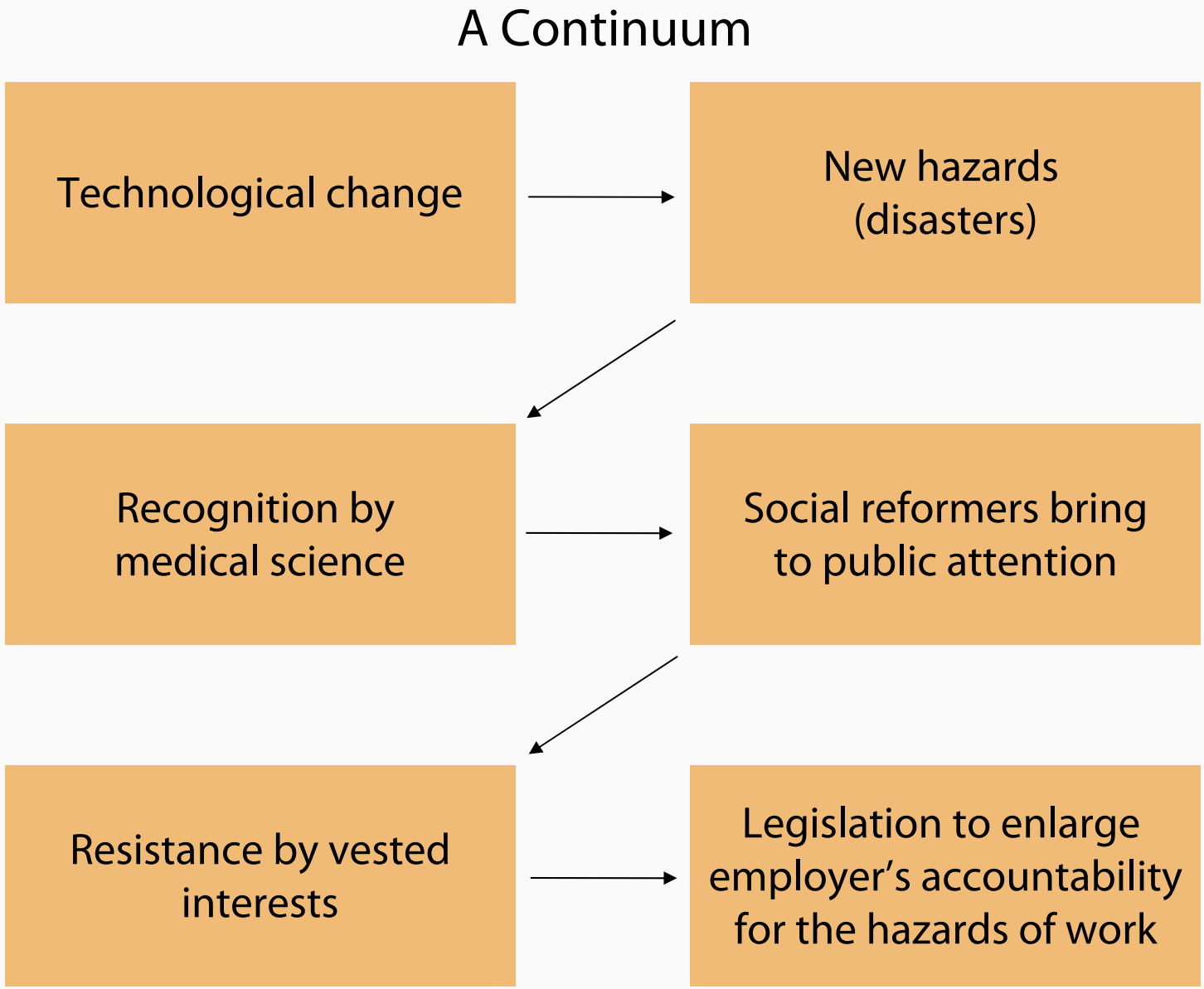
Two Important Reformers: Alice Hamilton

- Described lead poisoning in bathtub enamelers; phossy jaw in match makers; carbon monoxide poisoning in steel workers; heart disease in munitions workers; mercury toxicity in hatters; “dead fingers” in jack hammer users; neurologic disease in viscose rayon workers; cancer after benzene exposure

Laws Finally Arrive

- Workers' compensation laws
  - At first, vehemently opposed and legally challenged
  - All states passed from 1910 to 1948
- Coal Mine Safety and Health Act, 1969
- Occupational Safety and Health Act, 1970
  - Alice Hamilton dies at age 101, three months after its passage

Driving Forces for Occupational Health Reform



Leading 10 U.S. Work-Related Diseases and injuries

- Ten leading work-related diseases and injuries in the U.S. (1982) according to the CDC's National Institute for Occupational Safety and Health (NIOSH)
  1. Occupational lung diseases
  2. Musculoskeletal injuries and disorders
  3. Occupational cancers
  4. Severe occupational traumatic injuries
  5. Cardiovascular diseases
  6. Disorders of repetition
  7. Neurotoxic disorders
  8. Noise-induced hearing loss
  9. Dermatologic conditions
  10. Psychologic disorders

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The Burden of Occupational Disease: 2005

- U.S. has very diverse workforce
  - In 2005, there are
    - 147 million workers
    - 48% female
    - 28% minority
    - 15% over age 55 years

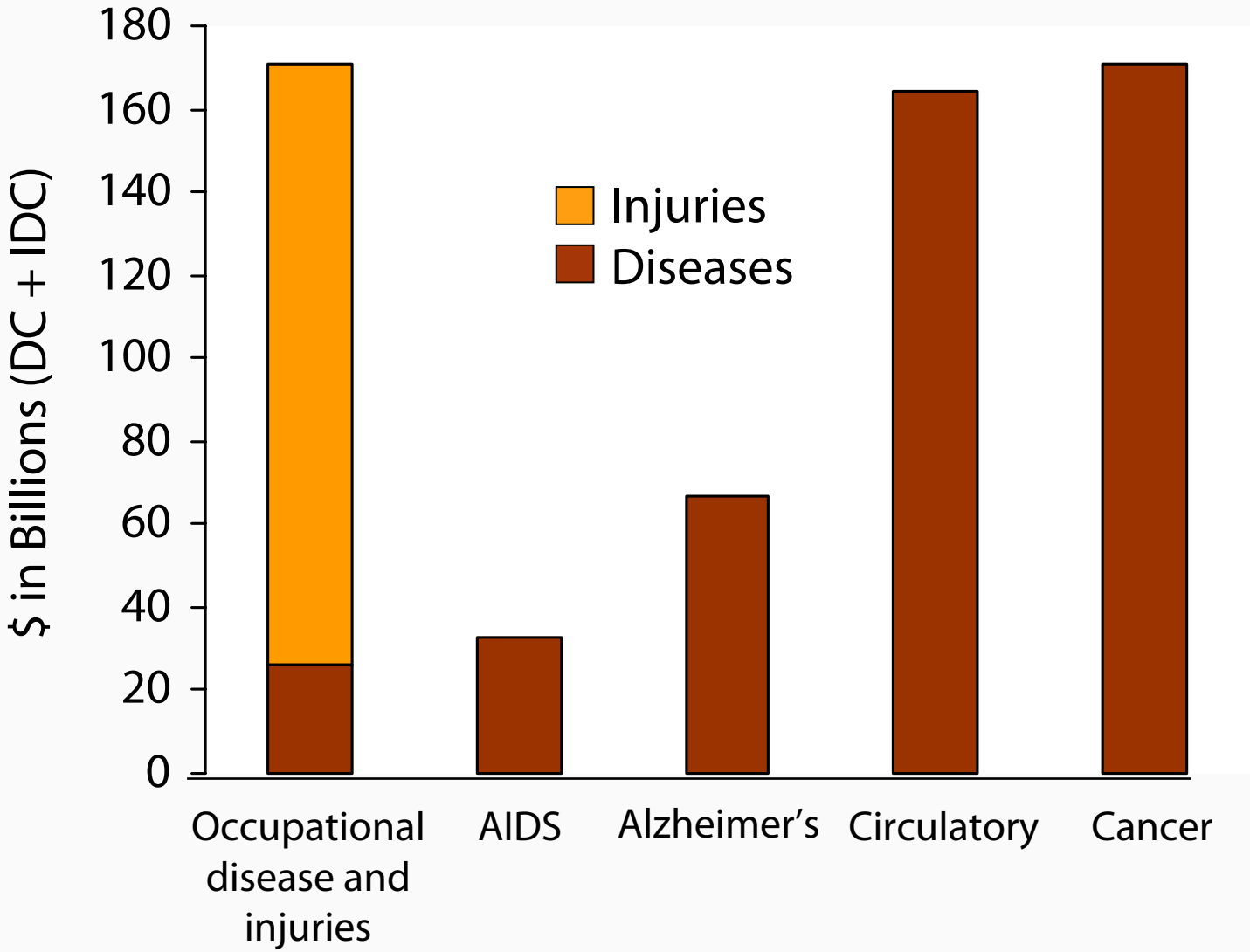
The Burden of Occupational Disease: 1994

- In 1994, employers reported
  - 6.3 million work injuries
  - 515,000 cases of occupational illness
  - Injuries alone cost $121 billion in lost wages, productivity, administrative expenses, and health care costs

The NIOSH NTOF Database

- The NIOSH National Traumatic Occupational Fatality (NTOF) database
  - 6,500 traumatic fatalities per year
- 1997 study, estimated for 1992
  - ~ 900,000 new occupational illnesses
  - ~ 65,000 occupational illness deaths

Economic Burden of Disease and Injury, 1997



Source: NIOSH. (May 1999).

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Section B

International Health and Development

Industrialization and Development: Detriments

- Development since World War II has meant
  - Industrialization and price-setting markets
- Industrialization involves
  - Processing of materials, discharging wastes
  - Air pollution, land degradation, water/soil toxification
  - Increasing occupational health problems

Industrialization and Development: Benefits

- The fruits of development
  - Improved diet, overall level of physical comfort
  - Increased material wealth is invested in social services, public health, medical care, water distribution, sanitation facilities

Kinds of Development Projects

- Roads and transport systems
- Water supply and sanitation
- Water resource development
  - Dams, irrigation—change distribution and flow of surface water
- Industrial facilities, mines
  - Multinationals in search of cheap labor, resources, new markets

Development Transitions

1. Demographic
   - From: “Traditional equilibrium”—stable population size with high death rates and high birth rates
   - Through: “Population explosion”—with rapidly declining death rates and stable birth rates
   - To: “Modern equilibrium”—birth rates decline and reach equilibrium with death rates

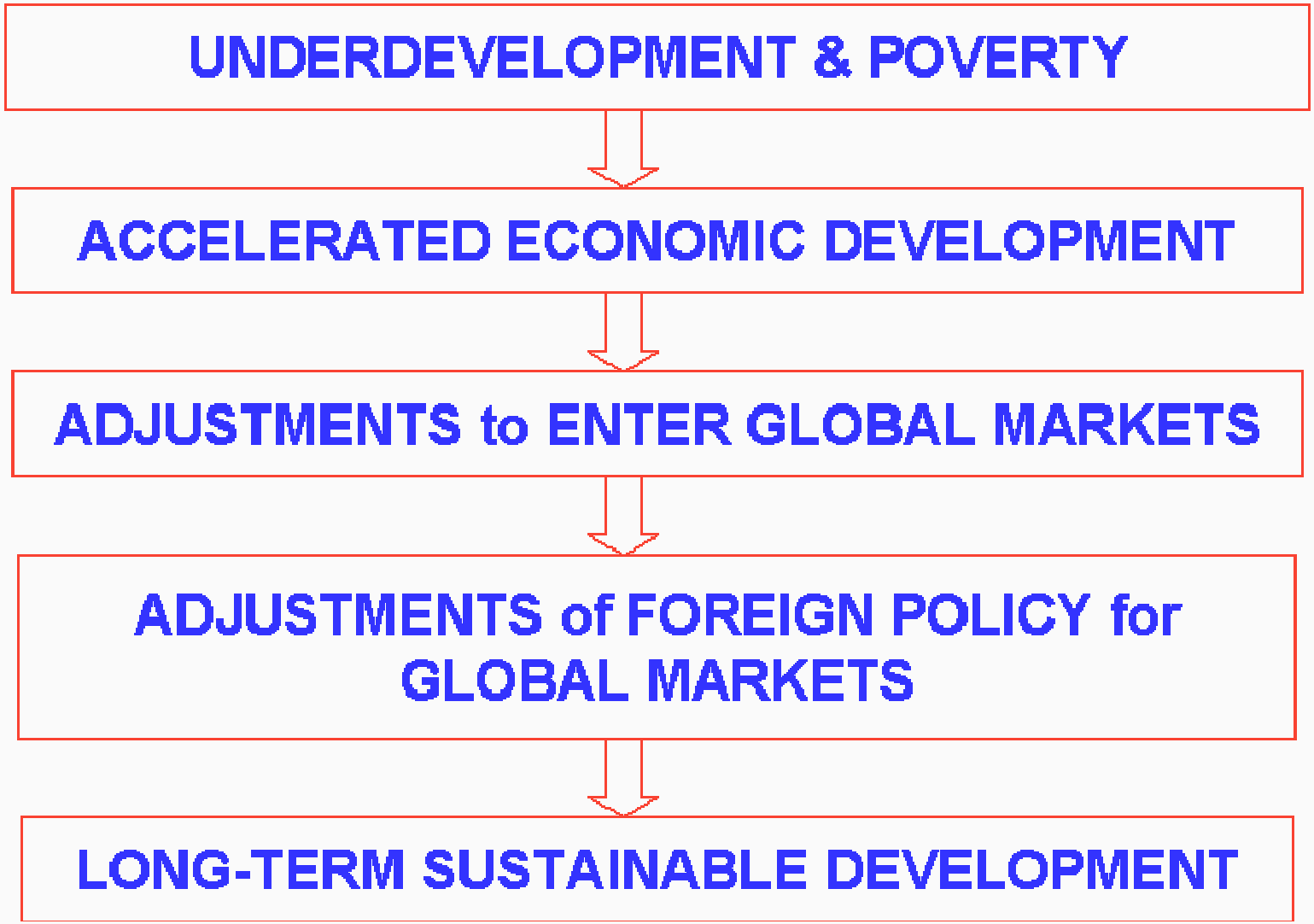
Development Transitions

2. Epidemiologic
   - Decline in “traditional” diseases (through sanitation, vaccination)
   - More “modern” diseases (cancer, heart disease, pollution)

Development Transitions

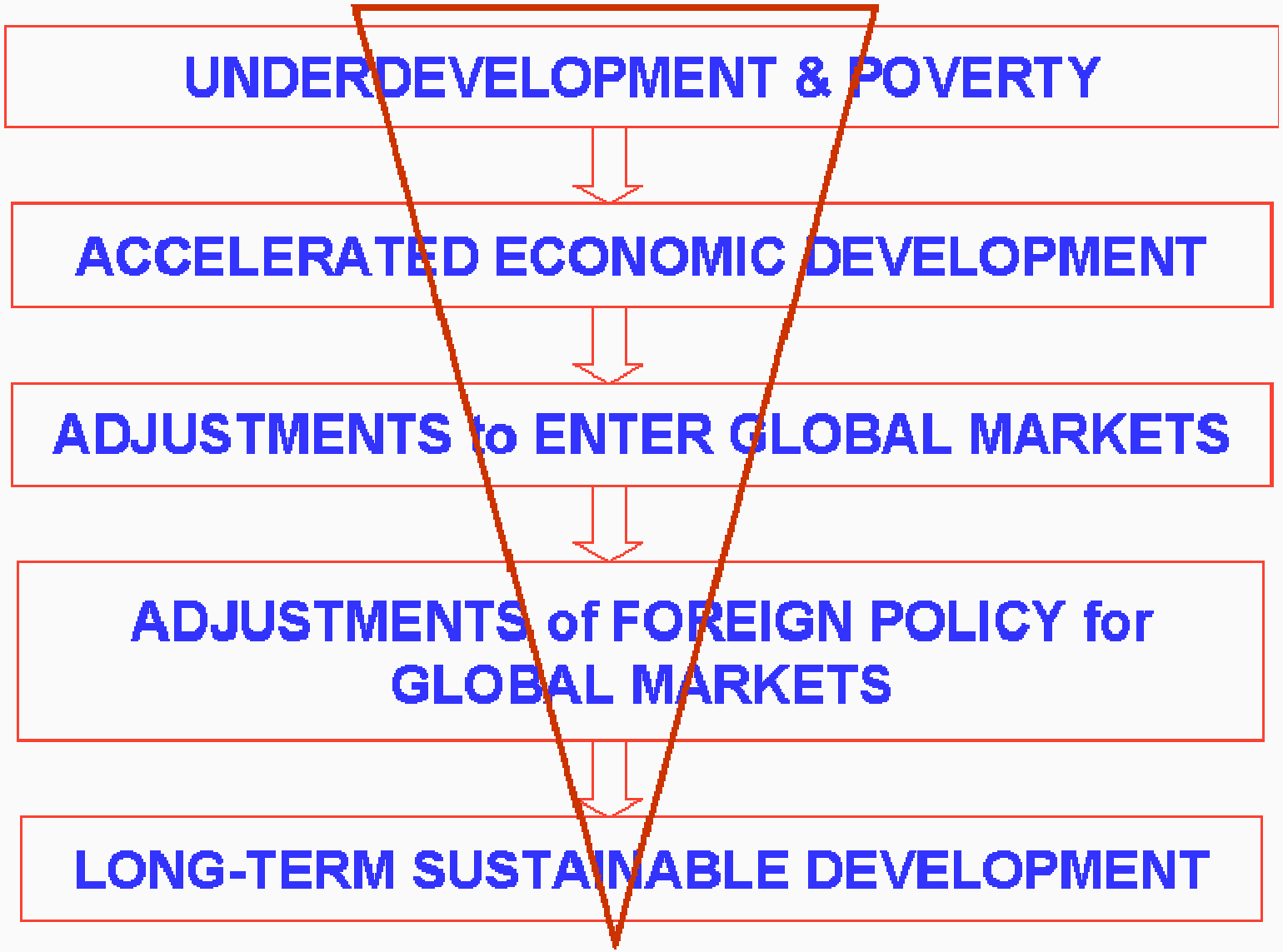
3. Risk
   - #2 (shift from traditional to modern diseases) due to underlying shift in risk factors—pollution, smoking, diet
   - With development, see new risks, interaction among risks, risk concentrating (equity), risk transfers (malaria vs. pesticides)

Stages in National Development



Source: Mendes.

"Mosaic Pattern" in Less Developed Country



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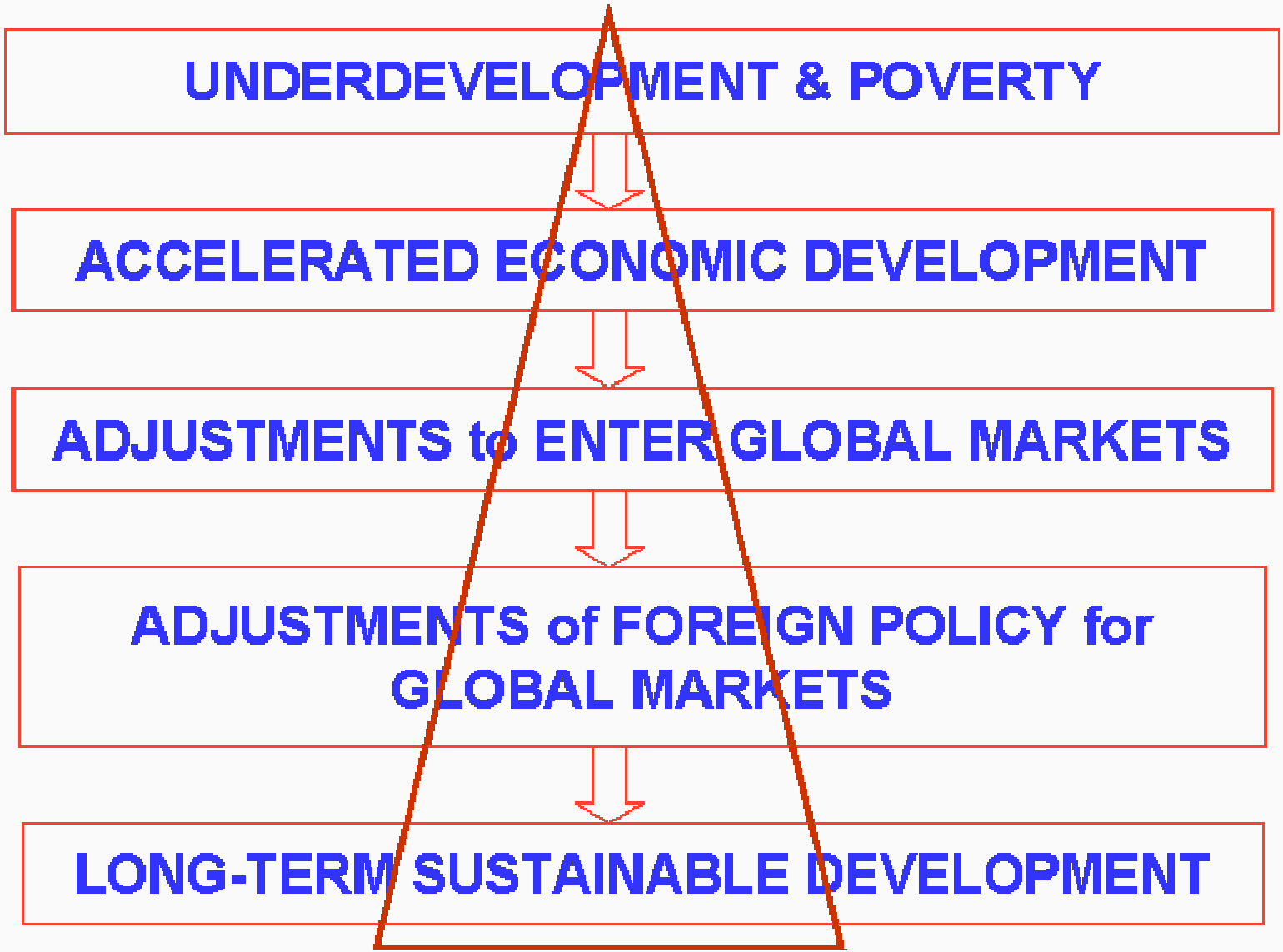

Source: Mendes.

Occupational Health Issues in Developing Countries

- Worker training and education levels of workers may be lower than in developed countries
- Child labor more prevalent in some countries
- Pre-existing levels of health may be lower

Occupational Health Issues in Developing Countries

- Nature of occupational health problems
  - Overt occupational diseases—chemical poisonings, pneumoconioses—more common; pesticide poisoning particularly problematic
  - Poorly controlled occupational health hazards

Occupational Health Issues in Developing Countries

- Less-developed surveillance systems
- Fewer laws in some countries
- Strong laws in other countries, but poor enforcement

Child Labor

- International Labor Organization (Geneva) has estimated child labor issues (1996)
- 250 million children between 5 and 14 working in developing countries; larger proportion of girls
  - Slaughterhouses, agriculture, carpet-weaving, domestic service, entertainment, mining, metal working
- 70% work under hazardous conditions

Child Labor

- Of global total, Asia has 61%, Africa 32%, Latin America 7%
- Of children between 5 and 14 years, 41% of those in Africa work, 22% in Asia, 17% in Latin America
- In U.S., child labor is an important issue on family farms and other selected workplaces

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Section C

Problem Solving, Monitoring, and Control

Types of Environmental Exposures (Factors, Stressors)

- Chemical hazards
  - Clinical toxicology
- Dusts and particulates
- Physical hazards
  - Temperature, pressure, vibration, radiation
- Ergonomic hazards
  - Exposure to these hazards causes work-related musculoskeletal disorders

Types of Environmental Exposures (Factors, Stressors)

- Biologic hazards
  - Infectious, allergic issues
- Psychologic hazards
- Safety hazards

Problem Solving in Occupational Health

- Three categories of problems
  1. Individual—clinical paradigm
  2. Population—epidemiologic methods
  3. Environment—industrial hygiene methods
- Obstacles to problem solving
  - Technical/scientific—no
  - Political/economic—yes

U.S. Model—Triangle of Prevention

Workers—Unions
Employers—Companies

Triangle of prevention of occupational disease and injury

NIOSH
Academia

MSHA
OSHA

Balance and/or tension between the above parties produces conflict and leverage → Driving prevention of occupational disease and injury

Source: (1998). Int Arch Occup Environ Health, 71, 159.

Healthy Work Approach, WHO (1997)

Setting / Orientation	Work	General (community/ society at large)
Physical Environment	Occupational Health and Safety	Sustainable Development
(Psycho-) Social Environment	Human Resource Management	Health Promotion

Controlling Hazardous Agents: Engineering, Ventilation

- Engineering controls
  - Substitution
  - Isolation or enclosure
  - Modification of process
- Ventilation
  - General area
  - Local exhaust

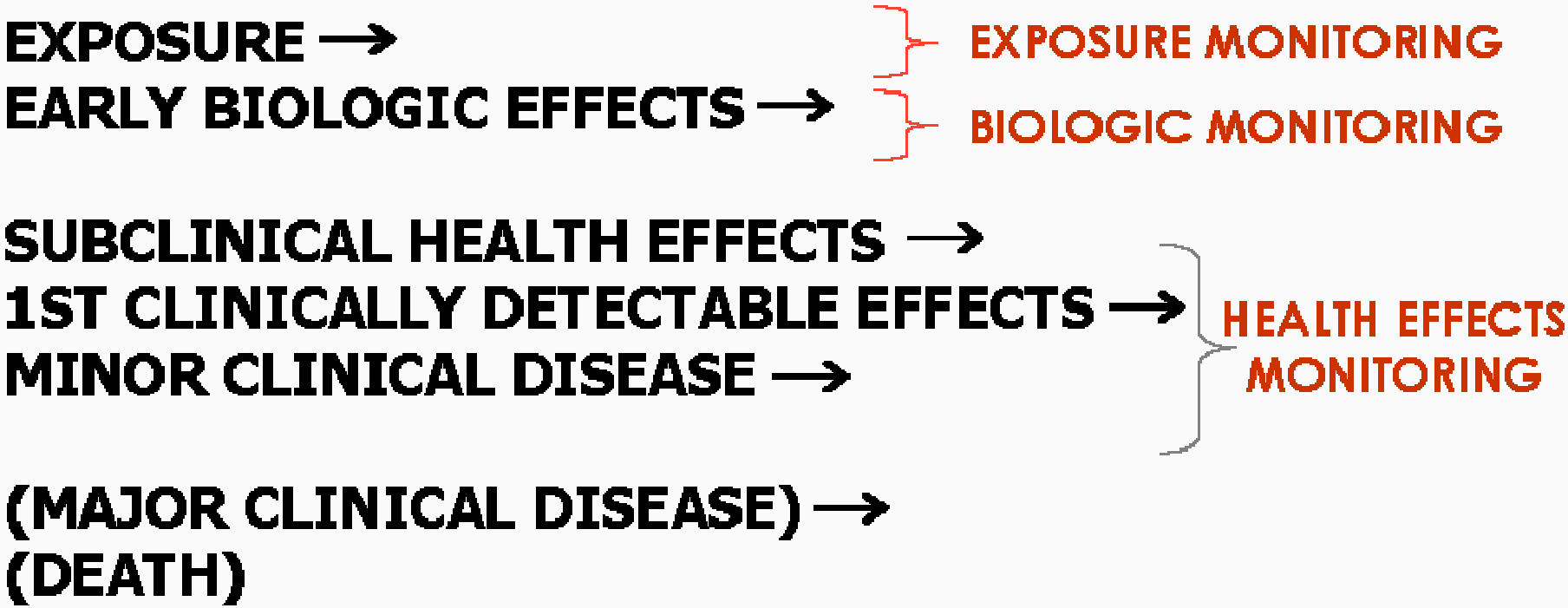
Controlling Hazardous Agents: Work Practices

- Work practices
  - Good housekeeping
  - Separate eating, washing, and changing areas
  - Wet methods
- Training and education of workers

Administrative Controls, Surveillance, Protective Gear

- Administrative controls
  - Limit exposure by rotation or decreased work hours
- Medical surveillance
  - Exposure assessment
  - Biologic monitoring
  - Health effects monitoring
- Personal protective equipment

The Continuum for Surveillance: A Framework



Biologic Monitoring

- The measurement and assessment of agents or their metabolites in tissue, secreta, excreta, or expired air, to evaluate exposure and health risks compared to an appropriate reference
  - Reference most often used—Biologic Exposure Index (BEI) of the ACGIH

Biologic Monitoring

- Only possible when sufficient toxicologic information is available on mechanism of action and on fate of chemical
  - BEIs are available only on about 35 agents

Biologic Monitoring Better Than Exposure Monitoring

- Closer to health effect
- Integrates ROUTES of exposure
- Integrates SOURCES of exposure
- Captures effects of PERSONAL PROTECTIVE EQUIPMENT
- Captures INDIVIDUAL VARIABILITY in work practices
- Captures INTER-INDIVIDUAL VARIABILITY in toxicokinetics

Health Effects Monitoring

- There are very few specific health effects of workplace exposures
- Generally use standard clinical tests to evaluate health effects in workers
- Must thus consider issue of low prevalence and positive predictive value

Medical Surveillance: Screening

- Medical history, physical examination, and lab tests to detect a specific disease process at an early, potentially reversible stage
- Focus on case identification
- Medical screening is one type of surveillance activity, if data are treated appropriately

Medical Surveillance: Health Effects Monitoring

- Health effects monitoring: "Screen again"
  - Periodic screening and other medical evaluations of individuals or groups of workers

Medical Surveillance: Group Analysis Surveillance

- Surveillance: "Analyze, interpret, and act"
  - The systematic collection, analysis, interpretation and dissemination of data on groups or populations
  - Use of data to direct active prevention programs

Occupational and Environmental (O/E) Disease

- Principles
  - Clinical and pathologic presentation of O/E diseases are indistinguishable from non-O/E diseases
  - Many diseases of O/E origin are multifactorial, with non-O/E factors playing a role
  - Effects of O/E agents occur after biologically predictable latent period

Source: Rosenstock and Cullen.

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  - Effects of O/E agents occur after biologically predictable latent period
  - Dose of O/E agent is strong predictor of probability and type of effect
  - Individuals differ substantially in responses to O/E exposures

Source: Rosenstock and Cullen.

The History: Three Essential Components

1. Description of current job
2. History of work with any known hazards (e.g., chemical, physical, biologic, ergonomic)

The History: Three Essential Components

3. Description of health problems thought by patient to be related to work
   - Change in symptoms during work day
   - Change in symptoms over work week
   - Change in symptoms on weekends and vacations
   - Onset of symptoms away from work

- Many standard instruments available

The Environmental Evaluation

- History may not be sufficient
- Obtain prior medical records
- Obtain Materials Safety Data Sheets from employer
- Obtain exposure records from employer
  - Relevant OSHA law

The Environmental Evaluation

- History may not be sufficient
- Obtain prior medical records
- Obtain Materials Safety Data Sheets from employer
- Obtain exposure records from employer
  - Relevant OSHA law
- Information from health and regulatory agencies
- Information from unions and community groups
- Perform a worksite visit

Specialized Use of the Laboratory

- Overall role of laboratory in OEM practice is surprisingly limited

Specialized Use of the Laboratory

1. Tests that elucidate pathophysiology
   - Detect effects, i.e., most general medical tests
2. Tests that identify or quantify exposure and dose
3. Tests that evaluate relation between exposure and effect (e.g., patch testing, challenge testing)

Making a Diagnostic Inference

- Exposure assessment databases
  - Link job to exposure
- Epidemiologic databases
  - Link exposure to disease
- Toxicologic databases
- Case reports and case series
- Clinical experience

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Section D

Regulation

Regulation of Workplace Exposures in the U.S.

- Toxic substances in the workplace regulated primarily through three federal laws:
  - Occupational Safety and Health (OSH) Act of 1970
  - Mine Safety and Health Act of 1969 (MSHA)
  - Toxic Substances Control Act of 1976 (TSCA)

Regulation of Workplace Exposures in the U.S.

- OSHA does not cover:
  - Self-employed, family-owned-and-operated farms, workplaces covered by other federal statutes, and state and local governments
  - Federal agencies—can't be fined
- Employers with ten or fewer employees exempt from:
  - Routine OSHA safety inspections
  - Record-keeping requirements

Other Agencies Concerned with Occupational Health

- Environmental Protection Agency (EPA) regulates users of pesticides
- Nuclear Regulatory Commission (NRC) regulates users of radioactive materials

Other Agencies Concerned with Occupational Health

- Department of Transportation regulates transportation safety (a major cause of work-related deaths and injuries) through:
  - National Highway Transportation Safety Administration
  - Federal Aviation Administration
  - Federal Railroad Administration
  - U.S. Coast Guard

Key Provisions of OSHA

- Ensure, if possible, that every employee has safe and healthful working conditions
- Require employers to maintain certain records
- Require employers to notify/train workers
- Provide procedures for investigating violations
- Can issue citations and assess monetary penalties against employers

Key Provisions of OSHA

- Can issue safety and health regulations and standards that have the force and effect of law
- Established National Institute for Occupational Safety and Health (NIOSH) to undertake health studies
- Provide half the funding for states that wish to establish state programs

Permanent Standards: Nine-Step Process

1. Decision to initiate development process
2. Drafting proposal, including economic and environmental impact
3. Advisory committee—all relevant parties
4. Revision and review
5. Publication in the Federal Register
6. Informal hearing for public comment
7. Staff analysis of records (major issues presented to the assistant secretary)
8. Final standard developed
9. Final standard published in Federal Register

Hazard Communication Standard (29 CFR 1910.1200)

- Hazards of chemicals "must be evaluated"
- Information transmitted to employers and employees
- Employers must have written program
  - Must include provisions for employee training, container labeling, materials safety data sheets (MSDS), employee training

Hazard Communication Standard (29 CFR 1910.1200)

- Employee training
  - Explanations of the requirements of standard
  - Details about chemical hazards in workplace
  - Details about methods and observations used to detect hazardous workplace chemicals

Hazard Communication Standard (29 CFR 1910.1200)

- Assessment of health hazards of chemicals
- Details on warnings, labels, MSDS, controls

Material Safety Data Sheets

- Chemicals covered highly variable in different jurisdictions—range from 300–30,000
- OSHA regulation
  - Basic list of ~600 chemicals
  - Requires "performance-oriented" evaluation of hazard potential of other chemicals

Material Safety Data Sheets

- Quality highly variable; toxicity and health effects data are often inadequate
- Data on MSDS do not quantitate exposures; provide no method to reliably determine “dose”

OSHA Enforcement: Theory

- OSHA identifies workplace hazards, promulgates rules to regulate hazards, and ensures compliance through enforcement
  - Enforcement strategy: Conduct inspections, issue citations, assess penalties for violations

Source: McQuiston, T. H. et al. (July 1998). American Journal of Public Health, 88, 7, 1022–1024.

OSHA Enforcement: Theory

- Classic deterrence theory
  - General deterrence: In short term, can dissuade firms from violating law if they believe non-compliance will be detected (certainty) and punishment will be severe and swift
  - Specific deterrence: If firm is caught, will be less likely to violate again

Source: McQuiston, T. H. et al. (July 1998). American Journal of Public Health, 88, 7, 1022–1024.

OSHA Enforcement: Theory

- If both general and specific deterrence are strong, compliance incorporated as organizational norm

Source: McQuiston, T. H. et al. (July 1998). American Journal of Public Health, 88, 7, 1022–1024.

OSHA Enforcement—Recent Data

- Certainty
  - OSHA inspections are infrequent ("every 144 years")
- Severity
  - Average federal penalty for "serious" = $763 (1995), 10% of maximum; "other than serious" = $52

Source: McQuiston, T. H. et al. (July 1998). American Journal of Public Health, 88, 7, 1022–1024.

OSHA Enforcement—Recent Data

- Swiftness
  - Average time from start of inspection to citation = 31 days for safety, 42 days for health (1996–1997)
  - 9.2% of these citations were contested—delays months to years

Source: McQuiston, T. H. et al. (July 1998). American Journal of Public Health, 88, 7, 1022–1024.

Impairment—Definition

- Impairment
  - Objective loss of organ or body part function
  - A medical determination
  - Supposed to be standardized, reproducible

Disability—Definition

- Disability
  - Impact of impairment on individual's functions at work or in society (alteration of capacity to meet personal, social, or occupational demands)
  - Impairment, work, home environment considered
  - Disability is an administrative decision made by persons who often are not health professionals

Three Major Disability Compensation Systems

1. Workers' compensation systems
   - Cause is determining factor for entry into system
2. Programs for the severely disabled
   - Inability to perform any gainful activity
   - Include Social Security Disability Insurance (SSDI) for contributing workers; Supplemental Security Income (SSI) for aged, blind, severely disabled

Three Major Disability Compensation Systems

3. Private disability plans
   - Protect income if unable to perform regular job duties, regardless of cause
   - Any illness preventing usual employment
   - Employer benefit or privately purchased

Americans with Disabilities Act

- 26 July 1990: President Bush signed into law P.L. 101-336
  - Extended existing rights and created new rights for 43 million Americans with disabilities

Americans with Disabilities Act

- The law requires that employers make
  - Reasonable accommodations
  - Which are not an undue hardship
  - So that any qualified individual with a disability can perform
  - The essential functions of a job

Coverage of Act

- The ADA prohibits discrimination against persons with disabilities in:
  - Employment (Title I)
  - Public programs and services (Title II)
  - Public accommodations and services operated by private entities (Title III)
  - Telecommunications (Title IV)

Coverage of Act

- The ADA charges the Equal Employment Opportunity Commission (EEOC) with issuing regulations to carry out Title I of the Act
- The ADA covers all employers with more than 15 employees

Examinations for Capability

- These examinations must relate to the employee's ability to do the essential functions of the job

Examinations for Capability

- Must consider *job demands*
  - Ergonomic evaluation; evaluation of physical and nonphysical job demands; time allocation to tasks
- Job analysis information should be used
  - Physicians must be familiar with specific job demands
- Considerations of job capability must be individualized

Worker Involvement in OHS

- Some recent trends
  - A decrease in U.S. manufacturing
  - An increase in service (including health care)
  - Decreased unionization
  - A decrease in proportion of those with “middle-class” incomes

Worker Involvement in OHS

- Unions
  - Try to regain some control over labor process through collective bargaining
  - 18% of U.S. workforce unionized; manufacturing = 12%
  - Much lower than in other Western industrialized countries

Labor Laws: Employer/Union Relationships

- Relationships between employers and unions are governed by laws that are designed to:
  - Make employers bargain fairly with unions on "conditions of employment" related to OSH
  - Protect unions/members in employer relationships
  - Ensure democratic procedures, sound fiscal practices

Labor Laws

- Include:
  - National Labor Relations Act (Wagner Act, 1935)
  - Labor-Management Relations Act (Taft-Hartley, 1947)
  - Labor-Management Reporting and Disclosure Act (Landrum-Griffin, 1959)

Ethical Concerns in Occupational Medicine

- Confidentiality
  - What are employers entitled to know about their employees?
- Tension between role as physician and corporate employee

Ethical Concerns in Occupational Medicine

- Nature of physician-patient relationship
  - Company physicians, relationship may be more complex
  - Primacy of obligation to treated patient still exists
- Other important issues

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Section E

Health Promotion in the Workplace

Health Promotion in the Workplace: 1980s Increase

- 1980s: Impressive increases in health promotion activities in the workplace
- Two studies in 1990s: Random samples
  - Office Disease Prevention and Health Promotion—1992 National Worksite Health Promotion Survey
  - CDC's 1995 Worksite Benchmark Survey

Health Promotion in the Workplace: Decrease in 1990s

- Overall decrease in health promotion activity prevalence from 12.0% in 1992 to 6.5% in 1995
  - Corporate downsizing
  - Uncertainty about effectiveness
  - Employers' perceptions of duplication of services—role of managed care

Health Promotion in the Workplace: Proof of Efficacy

- "Efficacy of worksite-based screening programs has not been conclusively established"

Purported Benefits of Workplace Health Promotion

- Improved employee health
- Reduced health care and other employee costs
- Increased productivity
- Decreased absenteeism, improved morale
- Easier recruitment of skilled/professionals
- Greater employee loyalty, reduced turnover

Purported Benefits of Workplace Health Promotion

- Ability to meet employee requests
- Enhancement of corporate image, public relations
- Dogma—health promotion yields $2–3 per $1 invested
  - Often based on company reports, not rigorous evaluations

Benefits of Workplace Health Promotion

- Long-term effectiveness studies not common
  - Studies expensive (> $1 million)
  - Few companies study programs
  - Many studies used for marketing purposes

Benefits of Workplace Health Promotion

- Warner (*J Occup Med,* 1988)—review of studies on cost-effectiveness
  - Methodologic errors
  - Little evidence of effectiveness
- Health promotion raises employee awareness of personal health issues; less clear how successful in affecting behavioral change

Summary of Benefits

- Health care costs
  - Some controversial supportive evidence
  - Some negative evidence
  - Overall: Little evidence to support claim
- Absenteeism
  - Several short-term studies show reductions

Summary of Benefits

- Health risks
  - Several short-term studies show reductions (blood pressure, cholesterol, body weight, Type A behavior)
- Attitudes towards health and company
  - Some supportive evidence; presence of program cannot negate consequences of other workplace changes