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The Health and Economic Benefits of Public Health Modernization in Oregon












Oregon Health Authority
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Acknowledgments

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Report at a glance

This report covers the economics of public health investments and estimates the ongoing cost to the Oregon population of selected preventable conditions. It includes examples of investments that have been recommended to close gaps in public health services that should reach all Oregonians. It shows the very small decreases in these costly, preventable conditions that would need to be achieved to offset the investments. These comparisons are presented not as requests for governmental public health funding. They are part of a growing body of evidence suggesting that upstream investment in the public health system of community organizations, health care providers, public health departments and the public can promote longer, more productive lives for all Oregonians.

Directing public investments toward evidence-based public health interventions offers the best chance to:

- Reduce preventable diseases
- Increase the population's lifespan and
- Reduce substantial costs to society and the public insurance system.

Benefits of public health investment

Researching the concrete, real-world health and economic benefit of public health spending is an emerging, scientifically challenging field. Although not all the evidence is in, research so far suggests that money spent on public health is a wise investment.

- A national study linked a 10% increase of total county health department spending with decreases in infant mortality, diabetes, heart disease and cancer. Applied to Oregon, that spending shift would be linked to the following annual reductions:
  - » 15 fewer infant deaths
  - » 16 fewer diabetes deaths
  - » 202 fewer heart disease deaths and
  - » 88 fewer cancer deaths.
- A study explored the relationship of counties' public health funding for maternal and child health to low birthweight. It found a per capita increase of less than $4 correlated with a 1 percentage point decrease in low birthweight in Washington state's high-poverty counties.

In Oregon, that would translate to an investment of $2.4 million in high-poverty counties. The linked decrease in low birthweight would:

» Avert 96 of these births (66 of them covered by Medicaid)

» Save an estimated $4.9 million in excess prenatal care and delivery hospital costs alone and

» Save $3.0 million in Medicaid spending in excess cost of prenatal care, delivery and the infants' first year of life. This includes hospitalizations, doctor visits and prescription drugs.

This report also estimates the cost of health care and poor health outcomes of some of the most common and unhealthful public health conditions — tobacco use, foodborne illness, physical inactivity and unintended pregnancy, as well as the cost of medical care and poor health outcomes due to health disparities. These conditions affect all Oregonians. Sound, peer-reviewed studies with results extrapolated to Oregon form the basis of these examples.

Tobacco prevention

Tobacco use is the state's leading preventable cause of death and results in more than 7,000 premature deaths each year.

- U.S. studies show that funding public health anti-tobacco programs results in fewer people smoking.
- Tobacco use costs Oregonians $2.5 billion a year in health care, lost productivity and premature death. Lowering tobacco economic costs by 1/16 of 1% would offset the recommended additional gap investment of $1.6 million.
- In Oregon, our annual investment to help close gaps in this program would result in more than 500 fewer adult smokers, saving more than $6 million in estimated medical costs over their lifetimes.
- Each dollar spent would save more than $4 in these costs over the former smokers' lifetimes. For Medicaid, each dollar spent would save more than $7.

Foodborne illness

Foodborne illness is common in the United States. It sickens one in six people each year; only 20% of these illnesses are identified by type.

- In Oregon, an estimated 123,000 illnesses per year are identifiable by type. However, most go unreported to doctors or the public health system.
- Foodborne illness costs Oregon approximately $229 million each year in health care, lost productivity and premature death.

- Lowering this economic burden by 2% through identification and prevention would offset the $3.9 million annual investment recommended to close the gap in the public health response.

Adult physical inactivity

Physical activity has widespread health benefits. These include increasing the chances of living longer; lowering the risk of obesity; improving mental health and mood; and decreasing the risk of some cancers, heart disease and stroke.

- In Oregon, four in 10 of all adults are completely sedentary or not sufficiently active.
- One in five adults are completely sedentary.
- The annual health care cost of physical inactivity is estimated at $1.3 billion overall and $360 million in Medicaid care. These costs do not include lost productivity or premature mortality.
- Lowering physical inactivity by 1/8 of 1% would offset the annual recommended investment of $1.6 million to close the gap in addressing physical inactivity.

Unintended pregnancy

This report covers unintended pregnancies that result in birth. A woman giving birth from an unintended pregnancy is less likely to seek prenatal care, less likely to breastfeed the infant and has a higher risk of depression after the birth occurs. Unintended pregnancies can be reduced by providing access to the information, services and resources necessary to ensure that all pregnancies are healthy, well-timed and intended.

- In Oregon, one in four births are from unintended pregnancies.
- In 2013, Medicaid covered almost seven in 10 births from unintended pregnancies — approximately 8,000 births.
- In 2013, Medicaid-covered hospitalizations for prenatal care and delivery for these births cost an estimated $17.7 million.
- Total health care for prenatal care, delivery and the infants' first year of life cost Medicaid an estimated $51.4 million.
- Reducing the costs of prenatal care, delivery and health care during the infants' first year of life by 5% would save $2.6 million in Medicaid costs for mother and infant care.

Health inequality

Health disparities result in higher premature death rates from a wide variety of conditions and lower quality of health care for communities of color. Social justice is reason enough alone to address health disparities. However, the economic burden is also high.

- In Oregon, the annual estimated cost of inequality is $316 million for health care, $53 million for lost productivity and $904 million in premature mortality.
- Health inequalities cost Oregon approximately $1.3 billion in health care, lost productivity and premature mortality each year.
- Reducing this economic burden by 0.4% would offset the $5.0 million annual investment recommended to close the gap in addressing health inequity.

This report's primary focus is the economic cost of poor health. Other consequences of poor health that can be reduced by investing in public health interventions — for example, strains on family budgets, a person's restricted activities and the emotional toll of pain and illness — are equally important, though they are beyond the scope of this report. The next sections of the report summarize more detailed findings.

Executive summary

In July 2015, the Oregon Legislature passed House Bill 3100 to modernize Oregon's public health system by adopting foundational capabilities and programs for governmental public health. The goal is ensuring that all people in Oregon have access to the same basic public protections, regardless of where they live.

In 2016, Oregon's governmental public health authorities assessed their current implementation of the public health modernization framework as adopted by the Legislature. The assessment identified gaps across all state and local health authorities in provision of these capabilities and programs.

This study estimates the economic and population health benefits of investments in prevention in selected program areas. The economic study found the following by extrapolating the results of national studies to health data.

Total public health spending

A 10% increase in per capita public health spending in Oregon links to:

- Lowering the infant mortality rate from 5.0/1000 to 4.6/1000, with an estimated 15 fewer infant deaths each year.
- Lowering the diabetes death rate from 24.1/100,000 to 23.8/100,000, with an estimated 16 fewer diabetes deaths each year.
- Lowering the heart disease death rate from 132.9/100,000 to 128.6/100,000, with an estimated 202 fewer heart disease deaths each year.
- Lowering the death rate from cancer from 167.3/100,000 to 165.4/100,000, with an estimated 88 fewer cancer deaths each year.

Low birthweight

In Oregon's high-poverty counties:

- An additional investment of $2.4 million in maternal and child health funding links to a 1 percentage point decrease in the low birthweight rate.
- A 1 percentage point decrease in the low birthweight rate would prevent 96 low birthweight births; Medicaid would cover 66 of these births.
- A 1 percentage point decrease in the low birthweight rate would result in an estimated $4.9 million savings overall in prenatal and delivery hospitalization costs alone; Medicaid savings would be an estimated $1.5 million.

- If Medicaid's total inpatient, outpatient and pharmacy costs for prenatal care, delivery and first year of life were included, a 1% decrease in the low birthweight rate would result in an estimated $3.0 million savings.

Tobacco prevention

Overall adult population

- Tobacco use costs Oregonians $2.5 billion a year in health care, lost productivity and premature death.
- Decreasing economic costs of tobacco use by 1/16 of 1% would offset the additional prevention investment recommended in the *Public Health Modernization Assessment Report*.
- The recommended additional prevention investment would result in an estimated annual 534 fewer smokers (quitters).
- $6.5 million is the estimated average savings in direct costs of medical care over the lifetime of the 534 former smokers.
- The return on investment for $1 of recommended additional prevention investment is $4.19 in estimated medical costs alone, saved over the former smokers' lifetimes.

Adult Medicaid population

- The return on investment for $1 of recommended additional prevention investment is an estimated $7.24 in medical costs alone, saved over the lifetimes of the former smokers currently enrolled in Medicaid.
- The recommended additional investment would result in an estimated annual 202 fewer smokers on Medicaid (quitters).
- The average savings in direct costs of medical care over the lifetime of the 202 former smokers is an estimated $2.5 million.

Foodborne illness

In 2014, for the 15 major pathogens that cause more than 95% of foodborne disease:

- The OHA Public Health Division received 5,280 reports of illnesses from foodborne pathogens.
- Many more occurred in the Oregon population but were not reported. Statewide, there were an estimated 123,000 domestically acquired reported and unreported foodborne illnesses.
- The 2014 economic burden of these illnesses is an estimated $229 million.

- Economic burden includes medical costs, productivity loss and death.
- Reducing the economic burden of foodborne illness by 2% would offset the additional investment recommended in the *Public Health Modernization Assessment Report*.

Adult physical inactivity

Overall adults

- Physical inactivity-related health care costs Oregon an estimated $1.3 billion overall each year.
- This does not include costs of lost productivity or death from conditions caused by physical inactivity.
- An estimated additional public health investment of $1.6 million would implement the physical activity portion of the *Public Health Modernization Assessment Report*'s improving nutrition and physical activity functional area.
- Reducing physical inactivity health care costs by at least 0.12% would offset additional spending recommended in the *Public Health Modernization Assessment Report*.

Medicaid adults

- Medicaid system health expenditures for physical inactivity are an estimated $360.5 million each year.
- Medicaid enrollees' additional public health investment portion is an estimated $346,000.
- Reducing physical inactivity health care costs by 0.10% in the Medicaid population would offset the additional investment portion of modernization funding for Medicaid enrollees.

Unintended pregnancy

This report covers unintended pregnancies that result in birth. In 2013,

- Medicaid covered almost seven in 10 births (68.4%) from unintended pregnancies — approximately 8,000 births.
- Approximately 1,600 of Medicaid births were unwanted; 6,400 were mistimed.
- Hospital deliveries for births from unintended pregnancies cost Oregon's Medicaid system an estimated $17.7 million.

- Non-Medicaid birth delivery hospitalizations from unintended pregnancies cost an estimated additional $4.3 million, for a total of $22.1 million.
- Total health care cost for births from unintended pregnancy prenatal care, delivery and the infants' first year of life cost Oregon's Medicaid system an estimated $51.4 million in 2013.
- Unintended pregnancies can be reduced by providing access to the information, services and resources necessary to ensure that all pregnancies are healthy, well-timed and intended. A 5% decrease in births from unintended pregnancies would have resulted in an estimated cost reduction of:
  - » $217,000 for inpatient non-Medicaid birth delivery hospitalizations
  - » $2.6 million in Medicaid costs of prenatal care, delivery and infants' first year of life.

Health inequality

Social justice is reason enough to address health disparities. However, the economic burden is also high. In Oregon,

- The annual estimated economic burden of health inequality for African Americans, Asians and Hispanics is:
  - » $316 million in direct health care costs
  - » $53 million in indirect cost of illness (productivity loss)
  - » $904 million in premature mortality costs
  - » $1.3 billion total of health care, illness and mortality costs.
- The recommended additional investment on health equity and cultural responsiveness in the *Modernization Assessment Report* is $5.0 million.
- Reducing the economic burden of health inequality by 0.4% would offset the additional investment to address this issue recommended in the *Public Health Modernization Assessment Report.*

Conclusion

The economic burden of population health conditions far exceeds the additional investment to close the gap in foundational public health services associated with those conditions. Investment in evidence-based prevention interventions offers the best opportunity for achieving this benefit.

Endnotes — executive summary

1. Berk Consulting. State of Oregon public health modernization assessment report. June 2016. [Internet] [cited 2016 Sept 9]. Available from: https://public.health.oregon.gov/About/TaskForce/Documents/PHModernizationFullDetailedReport.pdf.

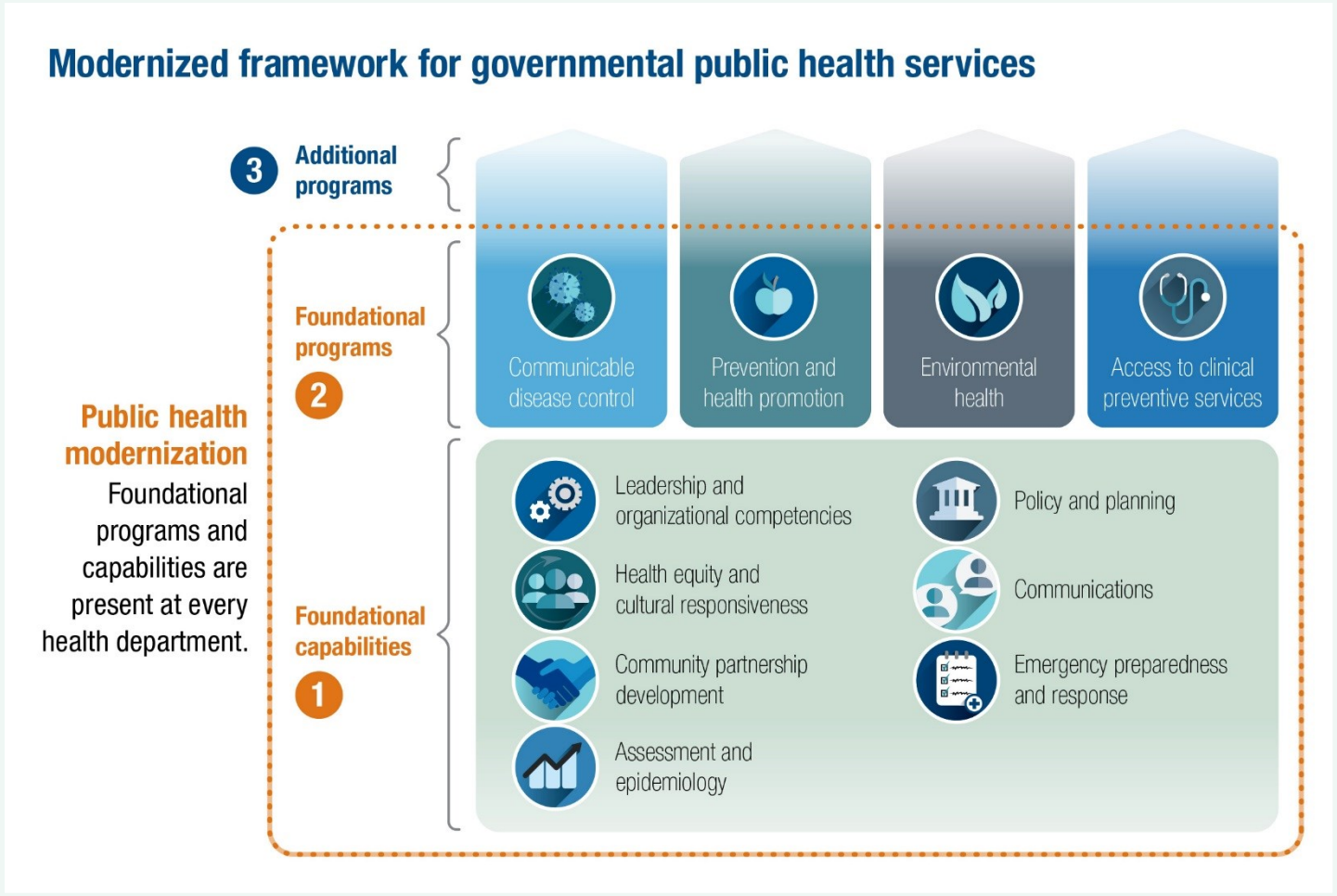
Introduction

The United States spends more per capita on medical care than any other industrialized nation. However, despite improvements in population health and longevity during the 20th century, the United States lags considerably behind many nations in overall life expectancy and the incidence of preventable diseases and injuries.(1) Experts have made a strong case for the country's lagging population health status resulting from inadequate investment in public health strategies that promote health and prevent disease and disability (1); these strategies are estimated to cost less than 5% of all national health spending.(2,3) Public health strategies can help contain medical care costs by addressing root causes of disease and injury at the population level through policy, systems and environmental change, thereby reducing the growth in medical care spending.

Considerable evidence exists for the effectiveness of population-based strategies to improve health.(4–6) However, there is only a small, but growing, literature about the extent to which differences in public health spending contribute to differences in population health. One recent study, using a national sample of county health departments, showed reductions in rates of infant mortality and reductions in deaths from heart disease, diabetes and cancer associated with a 10% increase in county public health spending.(7) Another study estimated a return on investment for public health spending in California county health departments of $67 to $88 for every $1 spent.(8) A third study found an increase of $10 per capita in public health spending reduced all-cause mortality by 9.1 per 100,000 in California.(9) These studies demonstrate public health spending is a good investment.

Recognizing the value of investing in public health, the U.S. Institute of Medicine recommended in its report, *For the Public's Health: Investing in a Healthier Future*, a minimum package of public health services with sufficient and sustainable funding. These include foundational programs and capabilities no health department should be without.(1) In July 2015, the Oregon Legislature passed House Bill 3100 to modernize Oregon's public health system by adopting foundational capabilities and programs for governmental public health as a framework for public health reform (see Figure 1).

Figure 1. Public health modernization conceptual framework



Foundational programs are those services necessary to assess, protect or improve public health. They include:

- Communicable disease control
- Prevention and health promotion
- Environmental public health
- Access to clinical preventive services

Foundational capabilities are the knowledge, skills or abilities necessary to carry out a public health activity or program. They include:

- Leadership and organizational competencies
- Health equity and cultural responsiveness
- Community partnership development
- Assessment and epidemiology

- Policy and planning
- Communications
- Emergency preparedness and response

In 2016, Oregon's governmental public health authorities assessed their current implementation of the public health modernization framework and the cost to fully implement it. The assessment, conducted by Berk Consulting, ended in June 2016 with a report, titled *State of Oregon Public Health Modernization Assessment Report.* The assessment identified gaps across all state and local governmental health authorities. The additional spending (also referred to in the report as "additional increment") needed for full implementation of foundational programs and capabilities was an estimated $105 million annually in 2016 dollars.

To facilitate funding recommendations for public health modernization in Oregon, the OHA Public Health Division contracted with Program Design and Evaluation Services (PDES). PDES is an interagency applied public health research and evaluation unit. PDES's task was to estimate the potential economic and population health benefits of public spending on Oregon's foundational public health services (i.e., foundational programs and capabilities).

Economic study approach

The economic study's goal was to estimate the benefit of additional spending to fully implement foundational public health services (FPHS) in concrete terms of Oregon lives saved and costs averted. To do this, the approach was to estimate the economic impact in Oregon based on:

- Existing published studies that calculated the benefit of investment (i.e., spending) in FPHS;
- Studies that calculated the benefit of spending on selected public health programs; or
- Studies that established the cost of population health conditions related to FPHS.

From these studies, we extrapolated the costs and benefits and calculated the minimal cost reduction necessary to offset the additional spending required to implement FPHS in Oregon. See Table 1 for a summary of the evidence.

Table 1. Categories of research related to public health spending and outcomes

Topic	Strength of evidence	Data sources
Spending on foundational public health services (FPHS)	No peer-reviewed studies	Not applicable
Total public health spending	Causal or strongly suggestive	U.S. local health department (LHD) spending and health outcomes California LHD spending and health outcomes
Public health spending in program areas related to FPHS	Mixed; few published studies	U.S. LHD spending and health outcomes
Cost of FPHS-related health conditions	Well documented	U.S. person-level health spending and health status U.S. health outcomes

Based on findings in the peer-reviewed literature, the economic impact estimation approach focused on three areas:

- Impact of overall public health spending
- Impact of spending in specific program areas included within FPHS
- Costs of population health conditions related to FPHS

Because FPHS encompasses a broad array of programs and health conditions, specific topics for the report **met the following criteria**:

Priorities

- They were included in the public health system's modernization priorities for the 2017–19 biennium (communicable diseases, environmental health, emergency preparedness, health equity, population health data and public health modernization planning); **or**
- They were included in the *2015 State Health Improvement Plan* (prevent and reduce tobacco use, slow the increase of obesity, improve oral health, reduce harms associated with alcohol and substance use, prevent deaths from suicide, improve immunization rates, and protect the population from communicable diseases); **or**
- They were otherwise suggested by OHA Public Health Division leadership for inclusion;

  and

Existing studies

- A relationship existed between public health spending (overall or FPHS-related) and outcomes; **or**
- Studies existed on the cost of health conditions tied to the foundational programs and capabilities in the *Public Health Modernization Assessment Report*.

Table 2 lists all topics included in the report and the type of economic impact estimate performed.

Table 2. Topics covered in the report

Topic	Type of impact estimate
Overall public health spending and mortality	Public health spending and outcomes
Maternal and child health spending and low birthweight	Public health spending and outcomes
Tobacco prevention	Cost of condition Actual return on investment of comprehensive tobacco program
Foodborne illness	Cost of condition Minimal cost reduction to offset additional spending
Health inequality	Cost of condition Minimal cost reduction to offset additional spending
Physical inactivity	Cost of condition Minimal cost reduction to offset additional spending
Unintended pregnancy	Cost of condition

Key economic analysis assumptions

Expectations of positive outcomes resulting from implementing evidence-based public health activities formed the basis of all estimated potential cost savings. Although there is very limited evidence for the relationship between public health spending and outcomes, there is considerable evidence for positive outcomes associated with public health interventions.(4–6) The estimates presented in this report assume when state and local public health departments pursue proven, evidence-based interventions to close the gap in FPHS, expected positive outcomes leading to population-level cost savings will occur.

All of this report's cost estimates are in 2015 dollars. They are all single values that do not include ranges of variability for each estimate.

Endnotes — introduction

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Total public health spending

Introduction

A growing body of evidence shows that public health spending is a good investment that saves lives and dollars. Two recent studies focusing on California found that:

- An additional $10 per capita of public health expenditures reduces all-cause mortality by 9.1 deaths/100,000.(1)
- A $1 investment in local public health departments generates a return on investment of $67.07 to $88.21.(2)

A nationwide study of spending and mortality in local public health departments found a 10% increase in public health spending correlated with:

- A 6.85% decrease in rates of infant mortality
- A 1.41% decrease in diabetes death rates
- A 3.22% decrease in heart disease death rates
- A 1.13% decrease in cancer death rates(3)

The results section below extrapolates the economic impact for Oregon based on the findings of this study.

Results

A 10% increase in Oregon public health departments' per capita spending would link to:

- Lowering the infant mortality rate from 5.0/1000 to 4.6/1000, with an estimated 15 fewer infant deaths each year.
- Lowering the diabetes death rate from 24.1/100,000 to 23.8/100,000, with an estimated 16 fewer diabetes death each year.
- Lowering the heart disease death rate from 132.9/100,000 to 128.6/100,000, with an estimated 202 fewer heart disease deaths each year.
- Lowering the cancer death rate from 167.3/100,000 to 165.4/100,000, with an estimated 88 fewer cancer deaths each year.

Documentation for estimate

Description of study used as basis for Oregon estimate

- The study included county-level spending data from local public health departments collected in a survey by the National Association of City and County Health Officials;
- Death rates from statistical files provided by the Centers for Disease Control and Prevention; and
- A data file on characteristics and health resources of these communities from the U.S. Health Resources and Services Administration.

The study correlated spending and death rates, controlling for factors that may influence both of these and confound results such as population density, urban or rural, poverty level and physicians per 100,000 population. As outcomes, the study looked at potentially preventable deaths that spending might affect — infant mortality, and age-adjusted death rates from heart disease, diabetes, cancer, influenza and from all causes. It compared these causes to a cause of death not likely to be sensitive to spending — Alzheimer's disease.(3) The study found relationships of spending with infant mortality, and age-adjusted death rates from heart disease, diabetes and cancer. Spending did not relate to deaths from influenza, all causes or Alzheimer's disease.

Note: The study states it "does not establish a definitive causal link between spending and mortality … it nevertheless provides compelling evidence that differences in public health investments may contribute to differences in community health outcomes."(3)

Assumptions for Oregon estimate

The correlations found in the national study (3) would also be found in Oregon.

The same decrease in a cause-specific age-adjusted death rate is in each of the 11 age groups used to compute the age-adjusted death rate. This assumption allows us to estimate the number of fewer deaths from this cause.

Local data sources

- Oregon infant death rates and number of infant deaths, 2011–2013 average(4)
- Oregon death rates and numbers of deaths for diabetes, heart disease and cancer, 2011–2013 average(5)

Calculations — see technical appendix

Endnotes — total public health spending

1. Brown TT. How effective are public health departments at preventing mortality? Econ Hum Biol [Internet]. 2014; [cited 2016 Aug 31]13(1):34–45. Available from: http://dx.doi.org/10.1016/j.ehb.2013.10.001.
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4. Center for Health Statistics, Center for Public Health Practice, Oregon Health Authority Public Health Division. Oregon linked birth & death certificates: Table generated in Oregon Public Health Assessment Tool (OPHAT), 2016 May 11.
5. Center for Health Statistics, Center for Public Health Practice, Oregon Health Authority Public Health Division. Oregon death certificates. Table generated in Oregon Public Health Assessment Tool (OPHAT), 2016 May 11.

Low birthweight

Introduction

One of the most commonly used indicators to monitor the health of mothers and children is the proportion of infants born weighing less than 2,500 grams, or approximately 5.5 pounds (referred to as the low birthweight rate). In Oregon,

- The low birthweight rate was 6.3% in 2013, an 11% increase since 2000.
- Low birthweight rates in Asian (7.8%), African American (10.3%) and Pacific Islander (10.6%) infants are higher than for White (5.9%) infants.(1)

An important public health goal is to ensure good health among mothers, infants and children. According to Healthy People 2020, "Their well-being determines the health of the next generation and can help predict future public health challenges for families, communities, and the health care system."(2)

Low birthweight infants are at increased risk for:

- Impaired development
- Infant death
- Other long-term disabilities such as cerebral palsy, blindness or other chronic conditions(1)

The results section below extrapolates economic and health impact to Oregon based on findings of studies on effectiveness of public health maternal and child health services funding in high-poverty counties and the cost of low birthweight births. It also includes an analysis of the cost of low birthweight births to Oregon's Medicaid system.

Results

In Oregon's high-poverty counties:

- An additional investment of $2.4 million in maternal and child health funding links with a 1 percentage point decrease in the low birthweight rate.
- A 1 percentage point decrease in the low birthweight rate would prevent 96 low birthweight births; Medicaid would cover 66 of these births.
- A 1 percentage point decrease in the low birthweight rate would result in an estimated $4.9 million savings overall in prenatal and delivery hospitalization costs alone; Medicaid savings would be an estimated $1.5 million.

- If Medicaid's total inpatient, outpatient and pharmacy costs for prenatal care, delivery and first year of life were included, a 1% decrease in the low birthweight rate would result in an estimated $3.0 million savings.

Documentation for estimate

Description of studies used as basis for Oregon estimate

Study 1: A 2014 study examined the relationships between local health department (LHD) *per capita* expenditures on maternal and child health (MCH) and low birthweight and infant mortality in Washington and Florida from 2000 to 2010.(3)

The study looked separately at:

- All counties in each state
- Within each state, all high-poverty counties

High-poverty counties were defined as the one-third of counties with the highest rates of childhood poverty.(4)

Overall, the study examined 90 pairs of spending and outcomes. Almost all of the relationships between different categories of MCH spending and low birthweight showed lower low birthweight rates related to more spending,

The strongest results focused on Washington's high-poverty counties. We chose to extrapolate the results of overall MCH spending and low birthweight because it related to an entire MCH program area and would be most relevant to calculating an estimate for Oregon, as opposed to (for instance) total spending (not specific enough) or spending on WIC (too specific). The study found for each *per capita* dollar spent, low birthweight declined by 0.284%.Thus, *per capita* spending of $3.52 (in 2010 dollars) linked to a 1% decrease in LBW.

Study 2: To assess the excess cost of a low birthweight birth, we used a 2006 study of the hospitalization costs of California births in 2000.(5) This study found the average cost (in 2003 dollars) of prenatal care and delivery was $41,790 for a low birthweight birth and $5,025 for a birth above low birthweight.

Assumptions for Oregon estimate

- The relationship of spending with health outcomes found in Study 1 would be the same in Oregon.
- The excess costs of a low birthweight birth are the cost of a low birthweight birth minus the cost of a normal birthweight birth.

- Costs of births above normal birthweight, which are included in the above-low-birthweight group, are so small they can be included in the normal birthweight group.
- The hospitalization costs of a normal birthweight birth and a low birthweight birth in 2000 equal those costs today, counting inflation.

Local and other data sources

- The Maternal and Child Health Section of the OHA Public Health Division provided a custom analysis of Medicaid claims for Oregon low birthweight and normal birthweight births.(6) Program Design and Evaluation Services is responsible for results presented in this report.
- Washington low birthweight by county tables for 2001 to 2010.(7)
- Oregon low birthweight by county data for 2014.(8)
- Oregon population by county estimates for 2014.(9)

Calculations – see technical appendix

Acknowledgement

We wish to acknowledge Mary Ann Evans, MS, MPH, PhD, and the Maternal and Child Health section for her work in providing Medicaid data in an original analysis for this chapter, without which Medicaid cost savings could not have been calculated.

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Tobacco prevention

Introduction

Tobacco use is the leading preventable cause of death, killing more than 7,000 people per year in Oregon.

Smoking:

- Causes lung cancer, cardiovascular disease and emphysema;
- Is linked to many other diseases such as diabetes, strokes and other types of cancer.

Medical expenditures and lost productivity due to premature death among smokers add up to $2.5 billion every year in the state.(1)

The following results section estimates decreased smoking prevalence and return on investment for the additional spending recommended in the *Public Health Modernization Assessment Report* for the prevention of tobacco use functional area, for the overall adult population and the Medicaid adult population.

Tobacco use

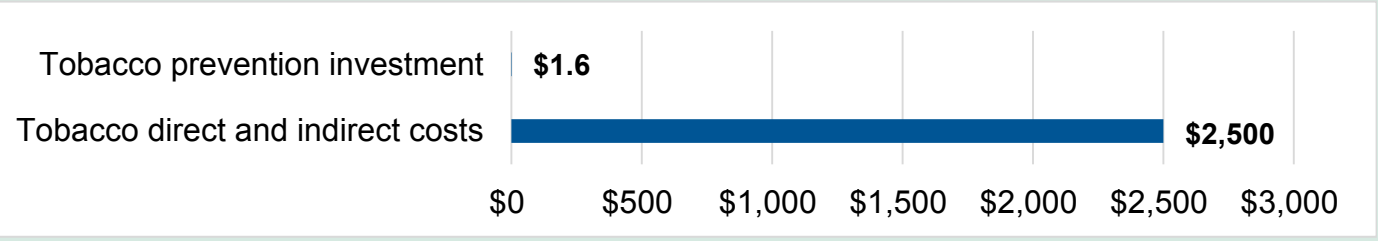
Burden

Tobacco use costs Oregonians **$2.5 billion** a year in health care, lost productivity and premature death.

Funding

Reducing tobacco economic costs by **1/16 of 1%** would offset recommended public health modernization investment of **$1.6 million**.

Oregon: Annual estimated economic cost and public health modernization investment for tobacco prevention (in millions)



Tobacco prevention return on investment

Burden

Tobacco use is Oregon's **leading cause** of preventable death.

Return on investment

Annual funding of **$1.6 million** would result in an estimated:

- **534** fewer smokers;
- **Savings of $6.5 million** in medical costs over the former smokers' lifetimes;
- More than **$4 saved** for every **$1 spent**.

SPENDING

SAVINGS

Results

Note: The results include the impact on adult smoking only.

Overall adult population

- The *Public Health Modernization Assessment Report*(1) recommends additional spending of $1.2 million for prevention of tobacco use in local public health departments. We estimate $358,000 in additional spending for this functional area would occur at the OHA Public Health Division, for a total of $1,558,000 in additional spending per year.
- Tobacco use costs Oregonians $2.5 billion a year in health care, lost productivity and premature death.
- Reducing tobacco use costs by 1/16 of 1% would offset the additional spending recommended in the *Public Health Modernization Assessment Report*.
- The recommended additional spending would result in an estimated annual 534 fewer smokers (quitters).
- The average savings in direct costs of medical care over the lifetime of the 534 former smokers is an estimated $6.5 million.
- The return on investment for $1 of recommended additional spending is an estimated $4.19 in medical costs alone, saved over the former smokers' lifetimes.

Adult Medicaid population

- We estimated $342,000 of the recommended $1,558,000 additional spending would reach adults currently enrolled in Medicaid.
- The recommended additional spending would result in an estimated annual 202 fewer smokers on Medicaid (quitters).

- The average savings in direct costs of medical care over the lifetime of the 202 former smokers is an estimated $2.5 million.
- The return on investment for $1 of recommended additional spending is an estimated $7.24 in medical costs alone, saved over the lifetime of the former smokers currently enrolled in Medicaid.

Documentation for estimate

Description of study used as basis for Oregon estimate

Two recent studies modeled the impact of increases in state-level spending on comprehensive tobacco control programs and the prevalence of adult cigarette smoking.(2,3) Although both report spending reduces prevalence, which adds weight to the evidence for effectiveness, we used the more recent study.(2) That study includes smoking and spending data from a more recent period (1991 to 2006) and controls for state excise taxes and smoking laws, as well as many other demographic variables for individuals. Success in stopping smoking may take multiple tries and years of encouragement. Therefore, the study takes a portion of previous years' expenditures into account in its spending model. However, the study still showed decreased prevalence even when previous expenditures were not taken into account, though the decrease was smaller. The main result of the study, which included a portion of previous years' spending, formed the basis for the estimates. The study reported a 10% increase in annual spending for comprehensive tobacco control results in a 0.09% decrease in adult smoking prevalence. We estimated the number of fewer smokers from additional spending based on this relationship, adjusted for Oregon's current and recommended additional spending for tobacco prevention and Oregon's prevalence of adult smoking.

To estimate costs saved by smoking prevalence decreases, we used a fact sheet from Campaign for Tobacco-Free Kids summarizing studies in the literature. The fact sheet estimated average higher lifetime medical costs for former smokers and never-smokers.(4) Although 20% of smokers initiate smoking at age 18 and older(5), we assumed all of the decrease in smoking prevalence are quitters, a conservative assumption since savings from quitters are less than savings from people who never smoke.

Assumptions for Oregon model

- Adults who quit smoking as a result of comprehensive tobacco funding do not relapse in future years. (A 1997 study of former California smokers found the likelihood of remaining abstinent from smoking was 95% for those who had quit for one year or longer.(6) Cultural disapproval and laws

restricting smoking have increased since the mid-1990s, so assuming minimal relapse for former smokers is probably reasonable.)

Local data sources

- Oregon prevalence of adult smoking for 2014, overall and for those covered by Medicaid.(7)
- Oregon estimates of the adult population, 2014.(8)
- Number of adults enrolled in Medicaid, 2014 average.(9)

Calculations — see technical appendix

Endnotes — tobacco prevention

1. Oregon Health Authority Public Health Division. Oregon tobacco facts 2013. [Internet]. [cited 2016 Aug 31]. Available from: https://public.health.oregon.gov/PreventionWellness/TobaccoPrevention/Pages/oregon-tobacco-facts.aspx.
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8. Portland State University (PSU), Population Research Center. PSU population estimates. Accessed in Oregon Public Health Assessment Tool (OPHAT).
9. OHA/DHS DSS warehouse; Member months tables, DateLoad: June 23, 2016.

Foodborne illness

Introduction

- Each year, one in six people in the United States are sickened by foodborne pathogens that can result in serious health outcomes including hospitalizations, long-lasting chronic health conditions and death.(1)
- The impact of foodborne illness is substantial, although most cases of foodborne illness are not reported to authorities and the economic burden must be estimated.(2)
- Oregon reports more foodborne illness outbreaks per capita than most other states in the nation. This reflects an effective system of surveillance and outbreak investigation compared to other states.(3)

Foodborne illness

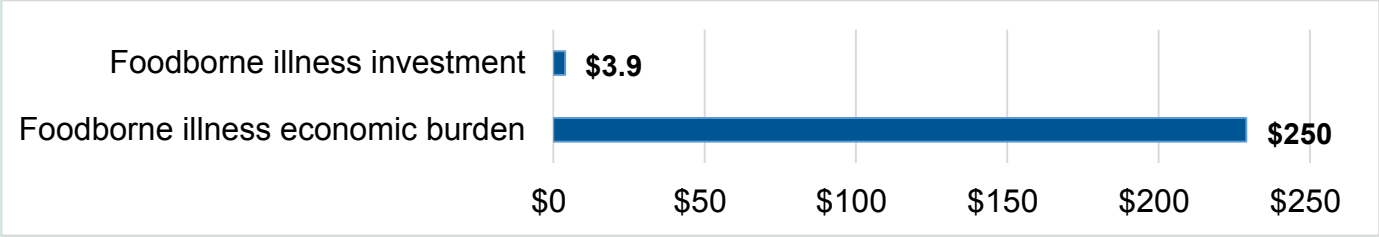
Burden

Foodborne illness costs Oregon **$229 million** each year in health care, lost productivity and premature death.

Funding

Reducing the economic burden by **2%** would offset recommended funding of **$3.9 million**.

Oregon: Annual estimated economic burden and public health modernization investment for foodborne illness (in millions)



The following results section extrapolates the economic impact for Oregon based on national studies on the total number and cost of U.S. foodborne illness.

Results

In 2014, for the 15 major pathogens that cause more than 95% of foodborne disease:

- The OHA Public Health Division received reports of 5,280 illnesses from foodborne pathogens.
- Statewide, there were an estimated 123,000 domestically acquired reported and unreported foodborne illnesses.
- The 2014 economic burden of these illnesses is an estimated $229 million.
- Economic burden includes medical costs, productivity loss and death.
- Reducing the economic burden of foodborne illness by 2% would offset the additional spending recommended in the *Public Health Modernization Assessment Report*.

Documentation for estimate

Description of studies used as basis for Oregon estimate

Study 1: A 2011 study of the number and health consequences of 31 major foodborne pathogens estimated 9.4 million episodes of reported and unreported illness occurred in the United States each year.(1) For each major pathogen, the study estimated underreporting, under-diagnosis, the percent travel-related and the percent foodborne. It also calculated the estimated final number for the United States. We used the ratios for some of these illnesses along with the number of reported illnesses in Oregon to estimate the total occurrence of illnesses (see calculations in technical appendix).

Study 2*:* Building on the estimate of illnesses from Study 1, this 2015 study estimated the economic burden from 15 pathogens that cause 95% or more of the foodborne illnesses, hospitalizations and deaths in the United States for which a specific pathogen cause can be identified.(2) We used the per-case economic burden estimates reported in the study to estimate the burden of foodborne illness in Oregon (see calculations in technical appendix).

Note: The estimated number includes illnesses from 15 major pathogens that cause 95% or more of foodborne illnesses with an identified specific pathogen. Those pathogens are Campylobacter, Clostridium perfringens, Cryptosporidium, Cyclospora cayetanensis, Listeria monocytogenes, Norovirus, Salmonella non-typhoidal species, Shigella, STEC O157, STEC non-O157, Toxoplasma gondii, Vibrio vulnificus, Vibrio parahaemolyticus, Vibrio other non-cholera species, and Yersinia enterocolitica.

Note: Both of these studies produced estimates that are uncertain because the researchers needed to make assumptions of the percent of underreporting and under-diagnosis, the number of doctor visits and other health episodes.

Assumptions for Oregon estimate

- The ratios of underreporting, under-diagnosis, travel-related and percent foodborne are the same in Oregon as estimated in the study for the United States.(1)
- The cost per case is the same in Oregon as estimated in the study for the United States.(2)
- The medical consequences of each condition — doctor visits, hospitalizations and deaths — are the same in Oregon as was estimated in the study for the United States.(2)

Local data sources

- Notifiable disease case reports(4)
- Other reports of selected communicable diseases from active surveillance(5)
- 2014 Oregon and national population estimates(6)

Calculations — see technical appendix

Endnotes — foodborne illness

1. Scallan E, Hoekstra RM, Angulo FJ, Tauxe R V, Widdowson MA, Roy SL, et al. Foodborne illness acquired in the United States – Major pathogens. Emerg Infect Dis. 2011; 17(1):7–15.
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Adult physical inactivity

Introduction

Physical inactivity, paired with poor nutrition, contributes to obesity. In Oregon,

- 39% of adults do not meet the Center for Disease Control's (CDC's) recommended physical activity level.
- 19% are completely sedentary.
- 20% are insufficiently active.(1)
- Note: The CDC recommends at least 150 minutes of physical activity (or 75 minutes of vigorous physical activity) per week and muscle-strengthening activities on two or more days a week.(2)

The CDC notes regular physical activity is "one of the most important things you can do for your health."(3) It:

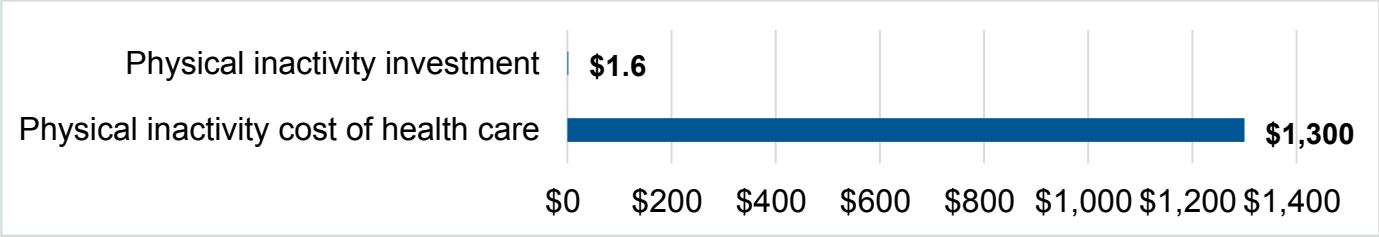
- Lowers the risk of obesity, some cancers and cardiovascular disease
- Strengthens bones and muscles
- Improves mental health and mood
- Increases the chance of living longer.

Adult physical inactivity

Burden
Physical inactivity-related health care costs Oregon **$1.3 billion** overall and **$360 million** in Medicaid costs each year.

Funding
Reducing physical inactivity health care costs by **1/8 of 1%** would offset recommended funding of **$1.6 million**.

Oregon: Annual estimated health care expenditures and public health modernization investment for physical inactivity (in millions)



The results section below extrapolates the economic impact for Oregon based on findings of a national study on expenditures for health care related to physical inactivity.

Results

Overall adults

- Annual medical care expenditures in Oregon related to physical inactivity is an estimated $1.3 billion.
- This does not include costs of lost productivity or death from conditions caused by physical inactivity.
- The additional public health investment needed to implement the physical activity portion of the improving nutrition and physical activity functional area from the *Public Health Modernization Assessment Report* is estimated at $1.6 million.
- Reducing physical inactivity health care costs by at least 0.12% would offset the additional spending recommended in the *Public Health Modernization Assessment Report*.

Medicaid adults

- Medicaid system health expenditures for physical inactivity is an estimated $360.5 million.
- The additional public health investment portion to Medicaid enrollees is an estimated $346,000.
- Reducing physical inactivity health care costs by 0.10% in the Medicaid population would offset the additional spending portion of modernization funding for Medicaid enrollees.

Documentation for estimate

Description of study used as basis for Oregon estimate

A 2015 study estimated the U.S. per capita direct expenditures for health care linked to insufficient physical activity in adults. The study compared health expenditures in completely sedentary (SED) and insufficiently physically active (IPA) adults with expenditures in adults meeting CDC's physical activity guidelines (PA).(4) It merged two U.S. surveys that asked for detailed information on:

- Physical activity — the National Health Interview Survey (NHIS) and

- Medical care expenditures — the Medical Expenditure Panel Survey (MEPS).

The study modeled annual total health care expenditures for all physical activity groups. Total health care expenditures included expenditures for all services: inpatient, outpatient, emergency room, office-based, dental, vision, home health, prescription drug and other. The study's model accounted for demographic differences. The average annual per capita expenditure difference between SED and PA adults and IPA and PA adults were $1,427 and $713, respectively, in 2012 dollars.

Assumptions for Oregon estimate

- Per capita expenditures for health care in physically inactive adults in Oregon and the United States are the same.
- Per capita expenditures from physical inactivity in the Medicaid and overall adult population are the same.
- The Medicaid system pays 90% of the Medicaid population's health care expenditures; 10% are out-of-pocket.

Local data sources

- Oregon BRFSS
- Oregon Medicaid BRFSS
- Oregon population estimates(5)
- Average annual number of Oregon adults enrolled in Medicaid, 2014(6)

Calculations — see technical appendix

Endnotes — adult physical inactivity

1. Oregon Behavioral Risk Factor Surveillance System (BRFSS) and Medicaid BRFSS. Data request provided by Program Design and Evaluation Services. 2014 MBRFSS State Total Data Tables_FINAL_v2.xlsx.
2. Centers for Disease Control and Prevention. How much physical activity do adults need? [Internet]. [cited 2016 Aug 31]. Available from: www.cdc.gov/physicalactivity/basics/adults/index.htm.
3. Centers for Disease Control and Prevention. Physical activity basics [Internet]. 2015. [cited 2016 Aug 31]. Available from: www.cdc.gov/physicalactivity/basics/.

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5. Portland State University (PSU), Population Research Center. PSU population estimates. Accessed in Oregon Public Health Assessment Tool (OPHAT).
6. OHA/DHS DSS warehouse. Member months tables, DateLoad: June 23, 2016.

Unintended pregnancy

Introduction

Unintended pregnancies are pregnancies that are unwanted or are mistimed (wanted later) at the time of conception. A birth from a pregnancy that is unintended can have serious health consequences for mother and child. Overall, the evidence for health problems is stronger for births that are unwanted than for births that are mistimed.

A woman giving birth from an unintended pregnancy:

- Is less likely to seek prenatal care(1)
- Is less likely to breastfeed the infant (breastfeeding has a protective effect against illness)
- Has a higher risk of mental health problems, like depression, after the birth occurs.(2)

A child born from an unintended pregnancy:

- May have poorer physical health than children whose mothers' pregnancy was intended
- May have worse relationships with their mothers, an effect that can last into adulthood.(2)

This report covers unintended pregnancies that result in birth. In Oregon, in 2013:

- One in four (26% of) births are from pregnancies that were unintended at the time of conception.
- 21% of births are from pregnancies that are mistimed; 5% are unwanted.
- 59% of births are from pregnancies that were intended at conception.
- In 15% of births, the mother was not sure what she wanted at conception.
- Women giving birth who Medicaid covers are almost twice as likely to have a child that is unintended (35%) than women not covered by Medicaid (18%).

Note: The overall proportion of pregnancies unintended in Oregon, including those that result in both birth and abortion, was 40% in 2012. The proportion of pregnancies that were unintended has been decreasing slowly from 52% in 2000 to 47% in 2011.(3) The 2012 figure (40%) can't be compared to the previous trend because of a substantial change in the way intendedness was measured starting in

2012.* The percent of births from unintended pregnancies shown above also can't be compared to data from previous years for the same reason. Nationally, 42% of unintended pregnancies end in abortion.(4) This report does not cover the costs of unintended pregnancies that result in elective or spontaneous abortions due to lack of local data.

The results section below estimates the cost of births from unintended pregnancies overall and to Medicaid-covered births.

Results

In 2013,

- Medicaid covered almost seven in 10 births (68.4%) from unintended pregnancies — approximately 8,000 births.
- Approximately 1,600 of all Medicaid-covered births were unwanted; 6,400 were mistimed.
- Hospital deliveries for births from unintended pregnancies cost Oregon's Medicaid system an estimated $17.7 million.
- Non-Medicaid birth delivery hospitalizations from unintended pregnancies cost an estimated additional $4.3 million, for a total of $22.1 million.
- Total health care cost for births from unintended pregnancy prenatal care, delivery and the infants' first year of life cost Oregon's Medicaid system an estimated $51.4 million.
- Unintended pregnancies can be reduced by providing access to the information, services and resources necessary to ensure that all pregnancies are healthy, well-timed and intended. A 5% decrease in births from unintended pregnancies would have resulted in an estimated cost reduction of:
  - » $217,000 for inpatient non-Medicaid birth delivery hospitalizations
  - » $2.6 million in Medicaid costs of prenatal care, delivery and infants' first year of life.

*A new response option to the question on intendedness was added to the Pregnancy Risk Assessment Monitoring System (PRAMS) survey in 2012. In addition to wanting a pregnancy sooner, later, then, or not at all, women can now respond that they "weren't sure" if they wanted to be pregnant or not. This has significantly changed the estimates for the intendedness of pregnancies that result in a birth. See https://public.health.oregon.gov/HealthyPeopleFamilies/DataReports/prams/Pages/index.aspx for the Oregon PRAMS surveys for previous and current years.

Documentation for estimate

Description of study used as basis for Oregon estimate

A 2013 study of the national economic burden of unintended pregnancy estimated the inpatient hospitalization cost of a live birth and other outcomes related to unintended pregnancies that do not result in a live birth.(4) The cost estimates came from the Medicare physician fee schedule and not from actual claims, but we could find no other studies looking at the costs of unintended births as a whole. The study assumed the cost of an unintended birth was the same as for an intended birth. This assumption supports a conservative result because unintended births are more likely to have costly risk factors.

The study also statistically adjusted the estimated cost of unintended births by taking into account mistimed births that were wanted later. If a mistimed birth were prevented, it is assumed it would occur at some future time as an intended birth. In the study, the cost per birth decreased with Oregon data on when in the future mistimed births would have been wanted. (See calculations in technical appendix.)

We used the estimate of cost per birth for all unintended births to estimate cost per birth for non-Medicaid unintended births for which we had no other data source. The study's estimate was for non-Medicaid and Medicaid births combined. As a result, our study may overestimate the non-Medicaid cost per birth because Medicaid births tend to be at higher risk. However, because this estimated cost was much less than the cost per birth from actual Medicaid claims data, we reasoned that would likely not be a problem. (See local data sources below and calculations in technical appendix.)

Assumptions for Oregon estimate

- The cost per non-Medicaid birth hospitalization estimated in the national study above is the same as the cost for an Oregon non-Medicaid birth hospitalization.
- Per-birth costs from unintentional pregnancies are the same as those for births from intended pregnancies.

Local data sources

- Data on Medicaid claims for Oregon births were provided by the Maternal and Child Health Section of the OHA Public Health Division.(5) Program Design and Evaluation Services is responsible for interpretation and results presented in this report.
- Data on the prevalence of pregnancy intendedness for Medicaid and non-Medicaid births were provided by the Maternal and Child Section of the

OHA Public Health Division analysis of the Oregon Pregnancy Risk Assessment Monitoring System, a survey of Oregon women who have recently given birth.(6) Program Design and Evaluation Services is responsible for interpretation and results presented in this report.

- Number of Oregon births, 2013 are from the Health Statistics Unit of the OHA Public Health Division.(7)

Calculations — see technical appendix

Endnotes — unintended pregnancy

1. Institute of Medicine (IOM). The best intentions. Washington, D.C.: National Academy Press. 1995 Logan C, Holcombe E, Manlove J, Ryan S. The consequences of Unintended Childbearing. Washington, DC [Internet]. 2007; (May).
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Health inequality

Introduction

In Oregon, as in the rest of the nation, there are wide disparities in health outcomes between communities of color and non-Hispanic Whites. Rates of a wide variety of health conditions – such as chronic disease, injuries, HIV diagnoses and infant mortality – are all higher in at least some of these communities. Obesity and smoking are also more common.

- African Americans and American Indian/Alaska Natives have higher premature death rates compared to non-Hispanic Whites.
- African Americans have the highest prevalence of asthma, diabetes and hypertension — conditions that can dramatically affect quality of life.
- Hispanic, African American and American Indian/Alaska Native women are more likely than non-Hispanic White women to receive prenatal care late.
- African American women are also more likely to have a low birthweight birth than women of other races and ethnicities.(1)

The following results section extrapolates the economic impact for Oregon from a study of the national economic burden of health inequality based on race/ethnicity.

Health inequality

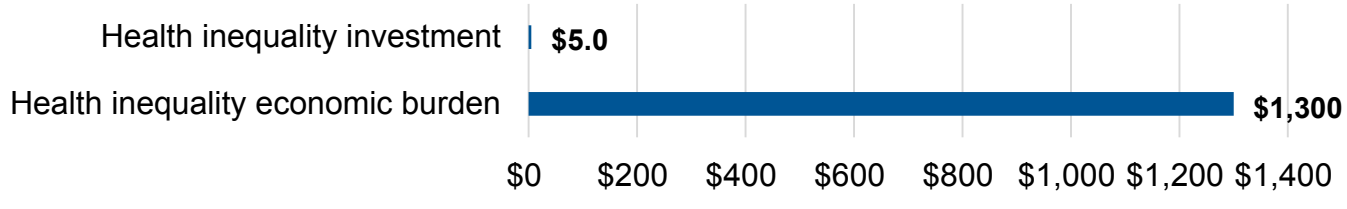
Burden

Health inequalities cost Oregon **$1.3 billion** in health care, lost productivity and premature mortality each year.

Funding

Reducing the economic burden of health inequality by less than **1/2 of 1%** would offset recommended funding of **$5.0 million**.

Oregon: Annual estimated economic burden and public health modernization investment for health inequality (in millions)



Results

Social justice is reason enough alone to address health disparities. However, the economic burden is also high. In Oregon,

- The annual estimated economic burden of health inequality for African Americans, Asians and Hispanics is:
  - » $316 million in direct health care costs
  - » $53 million in indirect cost of illness (productivity loss)
  - » $904 million in premature mortality costs
  - » $1.3 billion total of health care, illness and mortality costs.
- The recommended additional spending on health equity and cultural responsiveness in the *Public Health Modernization Assessment Report* is $5.0 million.
- Reducing the economic burden of health inequality by 0.4% would offset the additional spending recommended in the *Public Health Modernization Assessment Report*.

Note: This estimate of economic burden includes only inequality data for African Americans, Asians and Hispanics. Economic burden for Native Hawaiians and Pacific Islanders, American Indian/Alaskan Natives and people of more than one race were not available in the study used for extrapolation.

Documentation for estimate

Description of study used as basis for Oregon estimate

A 2011 study estimated the national costs of health inequality, using mortality data and data on medical expenditures and productivity for African Americans, Asians, Hispanics and Whites.(2) The study was the first to estimate such costs for the United States and characterized the huge costs of excess morbidity and mortality among people of color. The study found eliminating health inequalities would have reduced direct medical care expenditures by approximately $230 billion and indirect costs associated with illness and premature death by more than $1 trillion for 2003 through 2006 combined. We estimated the Oregon annual economic burden by applying the proportion of the U.S. population that lives in Oregon, by race, to the national results. We then summed the race-specific numbers for a total economic burden of inequality, dividing by four to get the annual average.

Assumptions for Oregon estimate

Oregon and the United States are the same for:

- Per capita direct and indirect costs for each race/ethnicity group
- Demographics (age, gender, education, health status, income, etc.) within each race/ethnicity group
- Inequalities by race for health status, morbidity and mortality

Local data sources

- Population of Oregon and the United States, by race/ethnicity for African Americans, Asians and Hispanics, 2015.(3)

Calculations — see technical appendix

Endnotes — health inequality

1. Oregon Health Authority Public Health Division. CD summary: Racial and ethnic disparities in Oregon. February 12, 2013; [cited 2016 Aug 31]. Vol. 62, No. 4. [Internet]. Vol. 62. 2013. Available from: https://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/CDSummaryNewsletter/Documents/2013/ohd6204.pdf.
2. LaVeist T, Gaskin D, Richard P. Estimating the economic burden of racial health inequalities in the United States. Int J Heal Serv. 2011; 41(2):231–8.
3. U.S. Census Bureau, Population Division. Annual estimates of the resident population by sex, race, and Hispanic origin for the United States, states, and counties: April 1, 2010 to July 1, 2015 Release Date: June 2016.

Limitations

- We assumed models from national studies (and in one case, from another state) can apply to Oregon.
    - We adjusted results based on available local data to improve estimates.
    - We made conservative assumptions that would tend to underestimate economic costs.
    - We stated assumptions in this report for transparency.
- The report does not include margin of error.
    - Calculating margin of error was beyond the scope of the report.
    - We rounded economic estimates in the results sections to reflect limitations in their precision.
    - Economic and health figures are best estimates.

Appendices

Appendix 1 – Total public health spending

Calculations

Infant mortality (Table 1)

- Study: A 10% increase in per capita public health spending is associated with a 6.85% decrease in the infant mortality rate.(1)
- In Oregon, the 2011–2013 average infant mortality rate was 5.0/1,000. 674 infant deaths occurred during this period.(2)
- 6.85% x 674 = 46 = reduction in infant deaths, 2011–2013.
- 46 ÷ 3 years = 15 = average annual reduction in infant deaths.

Table 1. Extrapolated reductions in infant mortality

	Rate/1000	Number	Population	Time period
OR actual	5.0	674	135,331	2011–2013
After 10% increase in funding*	4.6	628	135,331	2011–2013
Absolute reduction, 3 years*	0.3	46	135,331	2011–2013
Single year*	0.3	15	45,110	Based on 2011–2013 average

* Assumes a 6.85% decrease in deaths

Heart disease (Table 2)

- Study: A 10% increase in per capita public health spending is associated with a 3.22% decrease in the heart disease mortality rate.(1)
- In Oregon, the 2011–2013 average age-adjusted mortality rate was 132.9/100,000. 18,821 heart disease deaths occurred during this period.(3)
- A key assumption that allows the estimation of the number of fewer deaths in Oregon is that the rate would decrease by the same percentage in the 11 age groups used for calculation of age-adjusted rates. Thus, the total number of deaths would decrease by this percentage.
- 3.22% x 18,821 = 606 = reduction in heart disease deaths, 2011–2013.
- 606 ÷ 3 years = 202 = average annual reduction in heart disease deaths.

Table 2. Extrapolated reductions in heart disease

	Age-adjusted rate/1000	Number	Population	Time period
OR actual	132.9	18,821	11,697,803	2011–2013
After 10% increase in funding*	128.6	18,215	11,697,803	2011–2013
Absolute reduction, 3 years*	4.3	606	11,697,803	2011–2013
Single year*	4.3	202	3,899,268	Based on 2011–2013 average

* Assumes a 3.22% decrease in deaths in each of 11 age groups used for age-adjustment (crude or age-specific rates not provided in paper)

Diabetes (Table 3)

- Study: A 10% increase in per capita public health spending is associated with a 1.44% decrease in the diabetes mortality rate.(1)
- In Oregon, the 2011–2013 average age-adjusted mortality rate was 24.1/100,000. 3,347 diabetes deaths occurred during this period.(3)
- A key assumption that allows the estimation of the number of fewer deaths in Oregon is that the rate would decrease by the same percentage in the 11 age groups used for calculation of age-adjusted rates. Thus, the total number of deaths would decrease by this percentage.
- 1.44% x 3,347 = 48 = reduction in diabetes deaths, 2011–2013.
- 48 ÷ 3 years = 16 = average annual reduction in diabetes deaths.

Table 3. Extrapolated reductions in diabetes

	Age-adjusted rate/1000	Number	Population	Time period
OR actual	24.1	3,347	11,697,803	2011–2013
After 10% increase in funding*	23.8	3,299	11,697,803	2011–2013
Absolute reduction, 3 years*	0.3	48	11,697,803	2011–2013
Single year*	0.3	16	3,899,268	Based on 2011–2013 average

* Assumes a 1.44% decrease in deaths in each of 11 age groups used for age-adjustment (crude or age-specific rates not provided in paper)

Cancer (Table 4)

- Study: A 10% increase in per capita public health spending is associated with a 1.13% decrease in the cancer mortality rate.(1)
- In Oregon, the 2011–2013 average age-adjusted mortality rate was 167.3/100,000. 23,327 cancer deaths occurred during this period.(3)

- A key assumption that allows the estimation of the number of fewer deaths in Oregon is that the rate would decrease by the same percentage in the 11 age groups used for calculation of age-adjusted rates. Thus, the total number of deaths would decrease by this percentage.
- 1.13% x 23,327 = 264 = reduction in cancer deaths, 2011–2013.
- 264 ÷ 3 years = 88 = average annual reduction in cancer deaths.

Table 4. Extrapolated reductions in cancer

	Age-adjusted rate/1000	Number	Population	Time period
OR actual	167.3	23,327	11,697,803	2011–2013
After 10% increase in funding*	165.4	23,063	11,697,803	2011–2013
Absolute reduction, 3 years*	1.9	264	11,697,803	2011–2013
Single year*	1.9	88	3,899,268	Based on 201–2013 average

* Assumes a 1.13% decrease in deaths in each of 11 age groups used for age-adjustment (crude or age-specific rates not provided in paper)

Endnotes — public health spending appendix

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Appendix 2 – Low birthweight

Calculations

Note: calculations carried out in Excel include precision not shown in tables, so results may not agree with manual calculations carried out using integers shown

Overall population

- Excess hospitalization cost of a low birthweight birth (Table 1)
  - » Added average cost for mother and infant for a low birthweight birth
  - » Added average cost for mother and infant of a normal birthweight birth(1)
  - » Excess cost = cost of low birthweight birth – cost of normal birthweight birth

Table 1. Average hospital costs by low birthweight (LBW) category, California, 2000 (in 2003 dollars)

	Mothers	Infants	Total, mothers and infants
LBW (<2500g)	$7,820	$33,970	$41,790
Not LBW (>=2500g)	$3,378	$ 1,647	$ 5,025
Excess cost of LBW birth	$4,442	$32,323	$36,765
LBW (<2500g)	$7,820	$33,970	$41,790

- Inflated excess LBW cost to 2015 dollars using consumer price index for health care(2)
  - » $36,765 in 2003 dollars = $51,809 in 2015 dollars
- Expenditure of $1 per capita is linked to a decrease of 0.284% in low birthweight in Washington's high-poverty counties(3)
  - » 1%/.284% = $3.52 = per capita expenditure linked to 1 percentage point decrease in low birthweight (2010 dollars, from study(3))
- Inflate per capita expenditure to 2015 dollars using consumer price index for government public health activities(2)
  - » $3.52 in 2010 dollars = $3.90 in 2015 dollars.
- 1% of annual average number of births in Washington's high poverty counties, 2001 to 2010
  - » High poverty counties are defined as the tertile of counties with highest childhood poverty, identified with American Community Survey data.(4) In Oregon, they include Malheur, Jefferson, Harney, Crook,

Baker, Linn, Douglas, Morrow, Marion, Josephine, Lincoln and Wheeler counties.

  - » 11,936(5) x .01 = 119

- Per capita expenditure for a reduction of 1 low birthweight birth
  - » $3.90 ÷ 119 = $0.03
- Reduction of low birthweight births in Oregon's high-poverty counties by 1 percentage point = 1% of number of births in Oregon's high-poverty counties, 2014
  - » 9,553(6) x .01 = 96
- Population expenditure in Oregon's high-poverty counties to lower low birthweight rate by 1 percentage point = per capita cost to prevent 1 LBW x population x number of low birthweight births prevented (Table 2)

Table 2. Population expenditure to reduce low birthweight (LBW) birth by 1 percentage point, Oregon's high-poverty counties

Per capita cost of preventing 1 LBW birth	Population	Number of LBW births averted (1% of Oregon births)	Population expenditure to lower LBW birth by 1 percentage point
$0.03	796,242	96	$2,485,853

- Hospitalization cost savings of lowering low birthweight births by 1 percentage point = excess cost of one low birthweight birth x number of low birthweight births averted = $51,809 x 96 = $4,949,334.

Medicaid population

Note: These calculations do not protect Medicaid births dataset confidentiality.

- Inflated all health care cost data to 2015 dollars
- Calculate 1% of Medicaid births in Oregon's high-poverty counties
- Hospitalization cost savings, prenatal care and delivery
  - » [1] Sum of costs of low birthweight births, inpatient only
  - » [2] Cost per low birthweight birth = [1] ÷ number of low birthweight births
  - » [3] Costs of normal birthweight births (provided)
  - » [4] Cost per normal birthweight birth = [3] ÷ number of normal birthweight births
  - » [5] Excess cost of one low birthweight birth = [2] – [4]

- » [6] Cost savings = [5] X 1% of Medicaid births in Oregon's high-poverty counties

- Total costs savings for prenatal care, delivery and first year of life
  - » [1] Summed total costs for
    a. Low birthweight births
    b. Normal birthweight births
  - » [2] Cost per birth = [1] ÷ number of births for
    a. Low birthweight births
    b. Normal birthweight births
  - » [3] Excess cost of one low birthweight birth = Cost per birth of low birthweight birth – cost per birth of normal birthweight birth
  - » Cost savings = [3] X 1% of Medicaid births in Oregon's high-poverty counties

Endnotes — low birthweight appendix

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Appendix 3 – Tobacco prevention

Estimated recommended additional spending (Table 1)

- Current and recommended additional funding for Prevention of Tobacco Use functional area provided for LPHAs, but not for PHD.
  - » Calculate ratio of LPHA recommended additional funds in Tobacco functional area (FA) to LPHA recommended additional funds in Prevention and Health Promotion foundational program (FP).
  - » Apply ratio to PHD recommended additional funds for Prevention and Health Promotion=estimated PHD additional funding in Tobacco functional area.
  - » Estimate current PHD funding using the same method.

Table 1. Estimated current and recommended additional spending, tobacco prevention and control, Public Health Department (PHD) and local public health agencies (LPHAs) combined

	Estimation of recommended additional spending			Estimation of current spending		
	Prevention and health promotion	Prevention of tobacco use	FA/FP* ratio, FA/FP* for LPHAs	Prevention and health promotion	Prevention of tobacco use	FA/FP* ratio, LPHAs
LPHAs	$13,400,000	$1,200,000	0.09	$11,700,000	$ 3,900,000	0.33
PHD	$ 4,000,000	$ 358,209	N/A	$29,200,000	$ 9,733,333	N/A
Total, PHD and LPHAs		$1,558,209			$13,633,333	

*Functional area/foundational program

Estimated elasticity with additional spending (Table 2)

- Percent additional spending = additional spending / current spending
- Elasticity with additional spending = percent additional spending * elasticity in study(1) (Table 4 in national study). The elasticity in the national study is the estimated decrease in percent smokers with 1 percent additional spending.
- The estimated decrease in percent smokers with recommended additional funding = 11.4 x 0.009 = 0.10 percent.
- Elasticity applies to both overall spending increase and spending increase that would reach the Medicaid population since

Table 2. Estimated elasticity with additional spending

Current spending	Recommended additional spending	Percent increase	Elasticity in study, 1% additional spending	Elasticity with recommended additional spending
$13,633,333	$1,558,209	11.4	0.009	0.10

Estimated adult smoker prevalence and number of smokers (Table 3). All calculations in this section pertain to adults 18 and older.

- The survey used 2014 data unless otherwise noted to calculate the overall and Medicaid number of smokers.
- The overall current smoker prevalence(2) was multiplied by the estimate of the overall population(3) estimate the number of smokers.
- The Medicaid current smoker prevalence(1) was multiplied by the population enrolled in Medicaid(4) to estimate the number of smokers on Medicaid.

Table 3. Estimated adult smoker prevalence and number of smokers, Oregon, 2014

	Prevalence	Population	Number of adult smokers
Overall population 18+	17%	3,053,409	518,774
Medicaid population 18+	29%	670,483	196,720

The estimated recommended additional spending that would reach Medicaid adults is the proportion of adult population on Medicaid X the overall recommended additional spending (Table 4).

Table 4. Estimated additional spending that would reach Medicaid adults

Overall population 18+	Medicaid population 18+	Percent of adult population on Medicaid	Recommended additional spending	Estimated additional spending that would reach Medicaid adults
3,053,409	670,483	22.0%	$1,558,209	$342,159

Estimated lifetime medical cost per fewer smoker

- Assume all fewer smokers are smokers who quit.
- Lifetime medical cost savings of former smokers $9,500 (2004 dollars)(6)
- Inflate cost to 2015 dollars using health care consumer price index(7) = $12,237 (2015 dollars)

Estimated reduced prevalence and fewer smokers with recommended additional spending (Table 5)

- Prevalence with additional spending = current prevalence – elasticity with additional spending
- Number of smokers with additional spending = prevalence with spending X population
- Number fewer smokers = current number of smokers – number of smokers with spending

Table 5. Estimated reduced prevalence and fewer smokers with recommended additional spending

	Current			With rec. additional spending		
	Prevalence	Number	Elasticity	Prevalence	Number	Number fewer smokers
Overall population 18+	16.99%	518,774	0.10	16.97%	518,241	534
Medicaid population 18+	29.34%	196,720	0.10	29.31%	196,517	202

Estimated lifetime medical savings and return on investment of recommended additional spending (Table 6)

- Multiply number fewer smokers X lifetime medical savings per fewer smoker = population lifetime medical savings
- Return on $1 investment of additional spending = population lifetime medical savings ÷ recommended additional spending

Table 6. Estimated lifetime medical savings and return on investment of additional spending

	Number fewer smokers	Lifetime medical savings per fewer smoker	Population lifetime medical savings	Recommended additional spending	Return on $1 investment in lifetime medical savings
Overall population 18+	534	$12,237	$6,530,074	$1,558,209	$4.19
Medicaid population 18+	202	$12,237	$2,476,211	$ 342,159	$7.24

Endnotes — tobacco prevention appendix

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Appendix 4 – Foodborne illness

Calculations

- For 14 of 15 pathogens for which economic costs were estimated,(1) we calculated the ratio of estimated total U.S. domestically acquired cases ÷ laboratory confirmed cases ((2), the study's Table 2, p. 11). The estimated domestically acquired total, foodborne, column accounts for estimated under-reporting, under-diagnosis, percent travel-related and percent foodborne. We did not calculate a ratio for Vibrio vulnificus, since no cases occurred in Oregon in recent years.(3)

Table 1. U.S. pathogen-specific ratios, estimated domestically acquired total cases and lab-confirmed cases

Pathogen	Estimated domestically acquired total, foodborne	Lab-confirmed	Ratio, estimated total/lab-confirmed
Campylobacter spp.	845,024	43,696	19.3
Clostridium perfringens, foodborne	965,958	1,295	745.9
STEC O157	63,153	3,704	17.0
STEC non-O157	112,752	1,579	71.4
Listeria monocytogenes	1,591	808	2.0
Salmonella spp., nontyphoidal	1,027,561	41,930	24.5
Shigella spp.	131,254	14,864	8.8
V. parahaemolyticus	34,664	287	120.8
Vibrio spp., other	17,564	220	79.8
Yersinia enterocolitica	97,656	950	102.8
Cryptosporidium spp.	57,616	7,594	7.6
Cyclospora cayetanensis	11,407	239	47.7
Toxoplasma gondii	86,686	N/A	N/A
Norovirus	5,461,731	N/A	N/A

- For each of the 14 pathogens active in Oregon, the pathogen-specific ratio calculated in Table 1 was applied to the number reported in Oregon(4,5) to estimate the total reported and unreported foodborne illness in Oregon. The survey calculated Oregon population economic burden for each pathogen by multiplying by the estimated per-case economic burden(1).The sum was the total foodborne illness economic burden in 2013 dollars. For Toxoplasma gondii, Norovirus and Clostridium perfringens no local case counts were available because either the conditions was not reportable or surveillance was not systematic.(3) Table 2 shows the data source for each estimate.

Table 2. Estimated Oregon reported and unreported case counts and economic burden, 2013 dollars

Pathogen	Per case economic burden (2013 dollars)	Number of reported Oregon cases	Ratio, domestically acquired mean / lab-confirmed (U.S.)	Estimated Oregon total domestically acquired foodborne illness	Oregon population economic burden (2013 dollars)	Oregon number of cases data source
Listeria monocytogenes	$1,781,549	17	1.97	33	$59,635,589	FoodNet 2014 final
STEC O157	$ 4,298	74	17.05	1,262	$ 5,422,769	FoodNet 2014 final
Vibrio, other non-cholera species	$ 4,140	3.19	79.84	255	$ 1,054,367	CD surveillance summary and 2014 annual report, indicating 4% V mimicus, 7% V alginolyticus=11% "other non-cholera species"
Salmonella, all non-typhoidal species	$ 3,568	376	24.51	9,214	$32,877,247	FoodNet 2014 final
Yersinia enterocolitica	$ 2,848	21	102.80	2,159	$ 6,148,011	FoodNet 2014 final
Campylobacter, all species	$ 2,283	882	19.34	17,057	$38,940,530	FoodNet 2014 final
Vibrio parahaemolyticus	$ 1,174	25.81	120.78	3,117	$ 3,659,762	CD surveillance summary and 2014 annual report, indicating 89% is V parahaemolyticus
Shigella, all species	$ 1,051	45	8.83	397	$ 417,630	FoodNet 2014 final
Cryptosporidium, all species	$ 899	113	7.59	857	$ 770,745	FoodNet 2014 final
STEC non-O157	$ 243	110	71.41	7,855	$ 1,908,715	FoodNet 2014 final
Cyclospora cayetanensis	$ 202	1	47.73	48	$ 9,641	FoodNet 2014 final
Toxoplasma gondii	$ 38,114	N/A	N/A	1,079	$41,139,036	Oregon percent of U.S. population

Pathogen	Per case economic burden (2013 dollars)	Number of reported Oregon cases	Ratio, domestically acquired mean / lab-confirmed (U.S.)	Estimated Oregon total domestically acquired foodborne illness	Oregon population economic burden (2013 dollars)	Oregon number of cases data source
Norovirus	$ 413	N/A	N/A	68,007	$28,086,717	Oregon percent of U.S. population
Clostridium perfringens	$ 355	N/A	N/A	12,028	$ 4,269,797	Oregon percent of U.S. population

- The economic figures were inflated to 2015 dollars using the medical care consumer price index for the per case cost of medical care and the all urban consumer CPI for the cost of lost productivity and mortality (breakdown not shown).(6,7)

Table 3. Estimated Oregon economic burden, 2015 dollars

Pathogen	Per case economic burden (2015 dollars)	Number of Oregon cases (2014)	Ratio, domestically acquired mean / lab-confirmed (U.S.)	Estimated Oregon total domestically acquired foodborne illness	Oregon population economic burden (2015 dollars)
Listeria monocytogenes	$1,814,810	17	1.97	33	$ 60,748,973
STEC O157	$ 4,378	74	17.05	1,262	$ 5,524,011
Vibrio, other non-cholera species	$ 4,217	3	79.84	255	$ 1,074,052
Salmonella, all non-typhoidal species	$ 3,635	376	24.51	9,214	$ 33,491,058
Yersinia enterocolitica	$ 2,901	21	102.80	2,159	$ 6,262,793
Campylobacter, all species	$ 2,326	882	19.34	17,057	$ 39,667,542
Vibrio parahaemolyticus	$ 1,196	26	120.78	3,117	$ 3,728,089
Shigella, all species	$ 1,071	45	8.83	397	$ 425,427
Cryptosporidium, all species	$ 916	113	7.59	857	$ 785,135
STEC non-O157	$ 248	110	71.41	7,855	$ 1,944,350
Cyclospora cayetanensis	$ 206	1	47.73	48	$ 9,821
Toxoplasma gondii	$ 38,826	N/A	N/A	1,079	$ 41,907,094
Norovirus	$ 421	N/A	N/A	68,007	$ 28,611,090
Clostridium perfringens	$ 362	N/A	N/A	12,028	$ 4,349,513
Total		**5,280**		**123,368**	**$228,528,949**

- The Public Health Modernization report does not specify how much recommended additional spending would go to foodborne illness control. After consulting with the Medical Director of the Acute and Communicable Disease Section, we estimated based on current spending that roughly 30% of the additional spending for all functional areas of the Communicable Disease Control Foundational Program for PHD and LPHAs ($12.9 million) would go to foodborne illness control.(3) The total burden was divided by the recommended additional spending to calculate the amount foodborne illness would have to be reduced to offset the recommended additional spending.
    - » 30% X $12.9 million = $3.9 million.
    - » $3.9 million ÷ $229 million = 2% = the amount foodborne illness would have to be reduced to offset additional spending recommended in the modernization assessment report.

Endnotes — foodborne illness appendix

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Appendix 5 – Adult physical inactivity

Calculations for overall adult population

Per capita cost of physical inactivity

- The study classified adult physical activity into three categories, based on CDC guidelines:(1,2)
  - » completely sedentary
  - » insufficiently active
  - » active (meets CDC guidelines)
- The average annual health care per capita expenditure differences with active adults were (in 2012 dollars):
  - » $1437 for inactive adults
  - » $713 for insufficiently active adults
- These estimates were inflated using the consumer price index for health care (2015 dollars)(3):
  - » $1499 for inactive adults
  - » $744 for insufficiently active adults

Prevalence of physical inactivity in Oregon, 2013 (Table 1)

- For each physical inactivity category, the 2013 percent of adults in the category(4) x 2013 adult population(5) = number of adults in category

Table 1. Oregon adult (>=18) population prevalence of physical inactivity

	Percent	Population	Number of adults in physical activity category
Sedentary	18.5	3,053,409	566,285
Insufficiently physically active	20.0	3,053,409	611,323

Estimate of recommended additional spending (Table 2)

- The Public Health Modernization report recommended $2.4 million in additional spending for the Improving Nutrition and Increasing Physical Activity functional area in LPHAs (p. 81).

- We assumed half of this recommended spending would focus on physical inactivity in LPHAs ($1.2 million)
- The modernization report did not provide recommended additional spending by functional area for PHD.
- The modernization report provided recommended additional spending for the Prevention and Health Promotion (PHP) functional program. We assumed that:
  - » The proportion of funding in PHP focused on physical activity in LPHAs could be applied to the additional funding recommended for PHP in PHD to estimate the PHD recommended additional funding for physical activity, i.e.,
    $1.2 million ÷ $13.4 million = 8.96%
    8.96% x $4.0 million = $0.4 million
  - » Total of LPHA and PHD recommended additional spending =
    $1.2 million + $0.4million = $1.6 million

Table 2. Estimate of recommended additional spending (in millions)

	Recommended additional spending (millions)		
	Local public health agencies (LPHAs)	Public Health Department (PHD)	Total
Prevention and health promotion	$13.4	$4.0	$17.4
Nutrition and physical activity*	$ 2.4	$0.7	$ 3.1
Physical activity**	$ 1.2	$0.4	$ 1.6

*Estimated for PHD
**Estimated for LPHAs and PHD

Oregon health care expenditures and minimum reduction to offset recommended additional spending (Table 3)

- Per capita expenditure difference x population = population expenditure for each PA category
- Estimated additional spending ÷ population expenditure = minimum reduction in physical inactivity to offset additional spending = 0.12%

Table 3. Oregon health care expenditures and minimum reduction to offset recommended additional spending

	Per capita expenditure	Population in physical activity category	Population expenditure	Estimated recommended additional spending	Minimum reduction to offset recommended additional spending
Sedentary	$1,499	566,285	$ 848,959,270	$ 800,000	
Insufficiently physically active	$ 744	611,323	$ 454,731,591	$ 800,000	
Total	**N/A**	**1,177,608**	**$1,303,690,861**	**$1,600,000**	**0.12%**

Calculations for Medicaid adult population

- We assumed recommended additional funding would reach Medicaid adults in the proportion of total adults enrolled in Medicaid (in 2014 for Medicaid enrollment and population(5,6), latest year of data)
  670,483 ÷ 3,096,187 = 21.7%
  21.7% x $1.6 million = $347,000

The following tables show how the extrapolation to Medicaid adults were calculated using the equivalent method for overall adult population shown above. We assumed Medicaid would pay 90% of physical inactivity medical costs with 10% out of pocket, so per capita expenditures were multiplied by 0.9 in Table 5 to estimate the cost to the Medicaid system.

Table 4. Oregon Medicaid adult (>=18) population prevalence of physical inactivity

	Percent	Population	Population in physical activity category
Sedentary	28.2	670,483	189,043
Insufficiently physically active	23.5	670,483	157,450
Total			**346,492**

Table 5. Oregon Medicaid health care expenditures and minimum reduction to offset recommended additional spending

	Per capita expenditure (90% of overall per capita figure)	Medicaid population in physical activity category	Medicaid population expenditure	Estimated recommended additional spending	Minimum reduction to offset recommended additional spending
Sedentary	$1,349	189,043	$255,066,869	$173,241	
Insufficiently physically active	$ 669	157,450	$105,406,718	$173,241	
Total		**346,492**	**$360,473,587**	**$346,482**	**0.10%**

Endnotes — adult physical inactivity appendix

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5. Portland State University (PSU), Population Research Center. PSU population estimates. Accessed in Oregon Public Health Assessment Tool (OPHAT).
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Appendix 6 – Unintended pregnancy

Calculations

Number of unintended pregnancy Medicaid and non-Medicaid births and percent of unintended births that are Medicaid (Table 1)

- Prevalence of unintended births by Medicaid status (given)(1)
- Number of not-Medicaid births = total births(2) – Medicaid births(3)
- Number of unintended births:
  - » Overall: Total prevalence x total number of births = 11,465
  - » Medicaid: Medicaid prevalence x Medicaid number of births = 8,032
  - » Not Medicaid: Total unintended births – Medicaid unintended births = 3,433
  - » Percent of unintended births that are Medicaid: 8,032 ÷ 11,465 = 70%

Table 1. Prevalence and number of Medicaid and non-Medicaid births from unintended pregnancy, Oregon, 2013

	Unintended	Number of births	Number of unintended births
Not Medicaid	17.8%	22,017	3,713
Medicaid	34.7%	23,119	8,032
Total	26.0%	45,136	11,744

Number of Medicaid births that were unwanted or mistimed (Table 2)

- Number of mistimed Medicaid births = prevalence of Medicaid births that were mistimed x number of Medicaid births

Table 2. Number of Medicaid births that were unwanted or mistimed

	Mistimed			Unwanted		
	Percent	Number of births	Number births mistimed	Percent	Number of births	Number births unwanted
Medicaid	27.9%	23,119	6,441	6.9%	23,119	1,591

Cost per birth

- Researchers assume that a portion of mistimed pregnancies, if prevented, would simply occur later as intended births, so it is necessary to adjust observed costs downward to reflect the time shift.
- Inflated all costs to 2015 dollars using consumer price index for medical care(4)
- Adjusted cost per birth using the model followed in the study of cost of unintended pregnancy in the U.S.:
  - » Adjusted cost = Unadjusted cost x (1-f/1.05^d), where
    a. f = percent of unintended pregnancies that were mistimed and
    b. d = average delay wanted for mistimed pregnancies.(5)
  - » Calculated adjusted cost using data from PRAMS on distribution of how much longer until pregnancy was wanted(1).
    a. Assume average was midpoint of PRAMS response categories (row b)
    b. Prevalence for each category (row a) x average (row b) = row c
    c. Sum row c values for weighted average of wanted delay = 2.30465 years = d
    d. Note: we assumed d would be applied to both Medicaid and not Medicaid births because calculating d by stratifying Medicaid and non-Medicaid respondents would have resulted in unstable numbers due to small numbers

Table 3. Calculation of mean delay until intended for pregnancies from mistimed births

	Pregnancy Risk Assessment Monitoring System response categories					
Row	<1 Year	1 to 2 years	2 to 3 years	3 to 5 years	>5 years	Total
a	20.7%	29.9%	25.4%	16.0%	8.0%	100.0%
b	0.5	1.5	2.5	4	6	
c	0.1037	0.4488	0.63475	0.6392	0.4782	2.30465

Calculate adjusted per birth costs per case (Table 4)

- Note: Medicaid hospitalization costs include prenatal care and delivery. We did not have delivery-only costs and assumed moderate inpatient cost of prenatal care compared to total costs.

Table 4. Adjusted costs per birth

	Adjustment factors			
	Unadjusted cost per birth	F*	d**	Adjusted cost per birth
Not Medicaid births hospitalizations	$ 5,080	86.1%	2.30465	$1,170
Medicaid births hospitalizations	$ 7,786	80.2%	2.30465	$2,206
Medicaid prenatal care, birth and infant first year of life	$22,607	80.2%	2.30465	$6,405

*Percent of unintended pregnancies that were mistimed
**Average delay wanted for mistimed pregnancies

Total costs of unintended = cost per birth x number of unintended births (Table 5)

Table 5. Adjusted cost per birth, number of births and total costs for births from unintended pregnancies

	Adjusted cost per birth	Number of unintended births	Total cost
Not Medicaid births hospitalizations	$1,170	3,713	$ 4,343,619
Medicaid births hospitalizations	$2,206	8,032	$17,717,932
Total births hospitalizations			$22,061,551
Medicaid prenatal care, birth and infant first year of life	$6,405	8,032	$51,444,855

- Table 6 shows amount for 5% reduction in costs.

Table 6. 5% reduction in costs

	Cost	5%
Non-Medicaid births inpatient costs	$ 4,343,619	$ 217,181
Medicaid inpatient births costs	$17,717,932	$ 885,897
Total inpatient births costs	$22,061,551	$1,103,078
Medicaid costs of prenatal care, birth and first year of life	$51,444,855	$2,572,243

Endnotes — unintended pregnancy appendix

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Appendix 7 – Health inequality

Calculations

The paper we used for extrapolations reported the following results for the U.S.:(1)

Table 1. Economic burden of inequality, U.S., 2003 to 2006 combined (in billions) in 2008 dollars

	African American	Asian	Hispanic	Total
Direct	135.9	11.4	82	229.4
Indirect: Illness	36.6	0.1	13.7	50.3
Indirect: Death	746.2	0	211.3	957.5
Total, indirect (illness and death)	782.8	0.1	225	1007.9
Total, direct and indirect	918.7	11.5	307	1237.3

The survey multiplied the national estimates by the Oregon fraction of the population for each race to estimate the Oregon economic burden for 2003 to 2006 combined.

Table 2. Percent U.S./Oregon population ratio by race and estimated economic burden in Oregon (in billions) in 2008 dollars

	African American	Asian	Hispanic	Total
Oregon/US pop ratio	0.18%	0.99%	0.90%	
Direct	$0.25	$0.11	$0.74	$1.10
Indirect: Illness	$0.07	$0.00	$0.12	$0.19
Indirect: Death	$1.37	$ -	$1.91	$3.28
Total, indirect (illness and death)	$1.44	$0.00	$2.04	$3.48

To get an annual average, dollar figures in Table 2 were divided by 4.

Table 3. Oregon 2003 to 2006 health inequality economic burden annual average (in millions) in 2008 dollars

	African American	Asian	Hispanic	Total
Direct	$ 62.5	$28.2	$185.4	$ 276.1
Indirect: Illness	$ 16.8	$00.2	$ 31.0	$ 48.1
Indirect: Death	$343.2	$ -	$477.8	$ 821.0
Total, indirect (illness and death)	$360.1	$00.2	$508.8	$ 869.1
Total, direct and indirect	$422.6	$28.4	$694.2	$1,145.2

The race-specific dollar figures were added together to get the total economic burden of inequality, and inflated to 2015 dollars using the consumer price indices for medical care on direct health care costs and the CPI for all urban consumers for indirect illness and direct costs.(2,3) We assumed 2015 inflation was the same as inflation in 2014 for the medical CPI because 2015 data was not available.

Table 4. Oregon 2003 to 2006 health inequality annual average, in millions (in 2015 dollars)

	Total
Direct	$ 316
Indirect: Illness	$ 53
Indirect: Death	$ 904
Total, indirect (illness and death)	$ 957
Total, direct and indirect	$1,273

Endnotes — health inequality appendix

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