ALASKA HEALTHCARE COSTS

Alaska's Health-Care Bill: $7.5 Billion and Climbing

By Mark A. Foster and Scott Goldsmith

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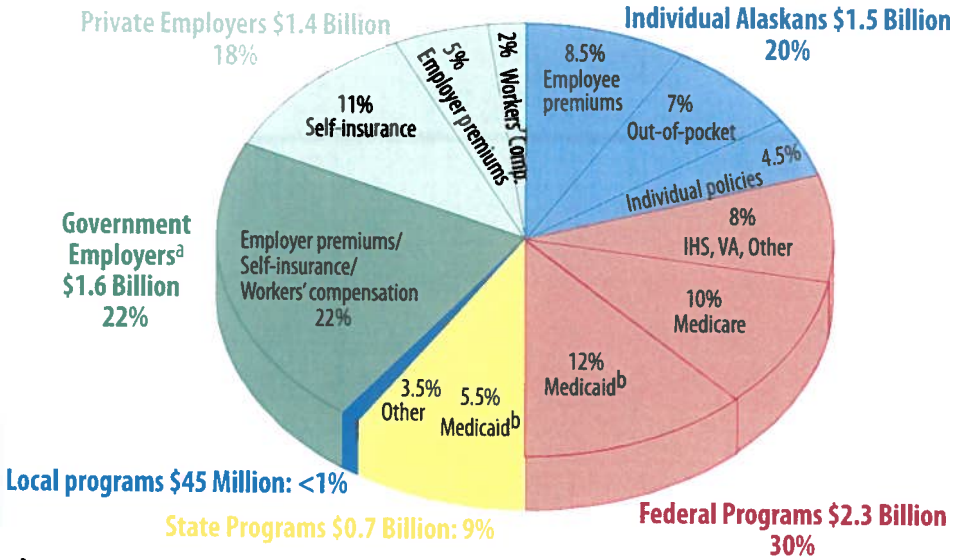
Figure 1. Who Pays for Health Care in Alaska?
(2010 Spending: $7.5 Billion)



[a] Insufficient data to break out categories
[b] The federal and state governments share the cost of Medicaid.

Source: Authors' estimates

Health-care spending for Alaskans reached about $7.5 billion in 2010. For comparison, that's close to half the wellhead value of all the oil produced in Alaska that year. It's also roughly equal to half the wages Alaskans collected in 2010.

The state's health-care spending has been rising fast, tripling since 1990 and jumping 40% just between 2005 and 2010—and at current trends it could double by 2020, reaching more than $14 billion.

Here we report on who's paying the bills, what we're buying, what's contributing to the growth, and other aspects of health-care spending. We conclude with a discussion of how Alaska could get better value for its health-care dollars.

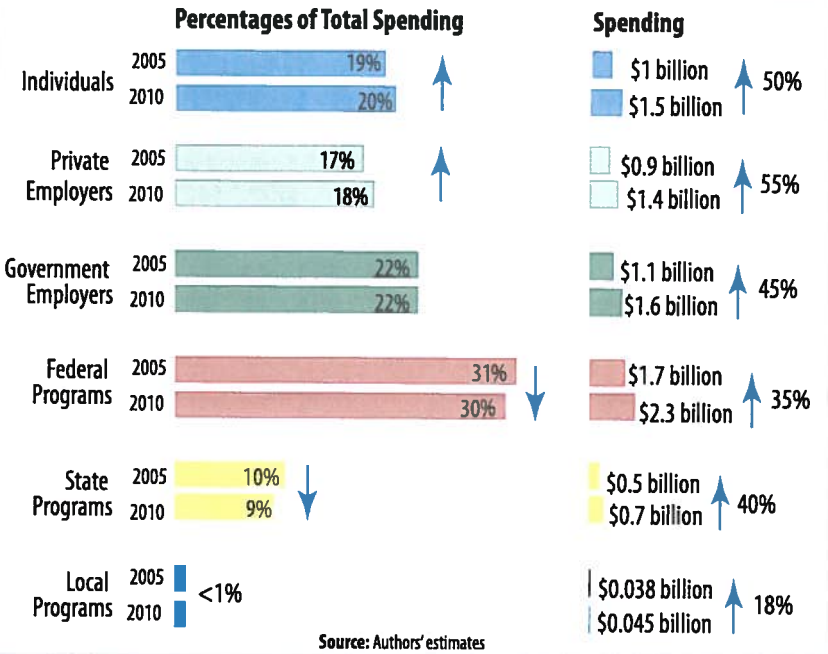
- ***Who pays the bills?*** Individual Alaskans directly pay about 20%, state and federal programs around 40%, and private and government employers another 40% (Figure 1 and page 2).
- ***What's the biggest cost?*** Medicaid is the largest single expense, making up nearly 18% of all Alaska health-care spending. But that's down from 20% of total spending in 2005. Why? Because spending for Medicaid didn't grow as fast as other kinds of spending (page 3).
- ***Are costs shifting?*** Every category of spending increased since 2005—but because spending by individuals and private employers increased faster, their shares of total spending increased (page 4).
- ***What are we buying?*** Hospitals and doctors account for nearly 60% of total spending—but the next largest cost is the 10% that goes for administering private and government health insurance (page 4).
- ***What's driving spending*** Over the past 50 years, technology, income growth, medical-price inflation, changing insurance coverage, and a growing, aging population have driven health-care spending (page 5).
- ***How many Alaskans are uninsured?*** The answer varies depending on how "uninsured" is measured and when. But recent estimates say about 18% of adults and 9% of children are uninsured. Based on 2010 census figures, that would be about 17,000 children and 94,000 adults (page 6).
- ***How many Alaska businesses offer health insurance?*** More than 90% of large firms offer insurance, compared with just 30% of small businesses—and that's down from 35% in 2003 (page 7).
- ***Are prices higher in Alaska?*** Yes. But Alaska's isolation, small markets, and other factors contribute to those higher prices—a day in the hospital costs on average 50% more than in the U.S. as a whole, and costs for common procedures are roughly 35% higher (page 8).
- ***How is spending distributed?*** Just 10% of Americans are responsible for two-thirds of all health-care spending in an average year (page 9).
- ***What about the future?*** Expanded insurance coverage; an aging population; and continued growth in technology, incomes, and medical prices will keep driving growth in health-care spending in the coming years. Controlling that growth will be an ongoing challenge (page 11).

How Have Patterns of Spending Changed?

Every category of health-care spending increased between 2005 and 2010, but the shares of spending shifted slightly among the various payers. We don't have enough information to say exactly what caused this shift—but several things likely contributed, as we describe below.

- *Individuals paid 20% of Alaska's health-care bills in 2010, up from 19% in 2005.* As costs of health-care benefits increased rapidly, employers shifted more of those costs to employees (see page 7). Also, prices for policies individuals buy directly increased significantly.
- *Private employers' share of spending increased from 17% to 18%.* That increase was in part because private industry added nearly four times more jobs than governments did since 2005—and at least some of that bigger base of employees had health-care coverage.
- *Government employers' share of spending was about the same, at 22%.*
- *Government health programs accounted for a somewhat smaller share of spending, down from about 41% to 39%.* The federal and state governments have attempted to hold down growth in costs of health programs—but federal programs alone continue to make up nearly a third of all Alaska's health-care spending. Local government spending for health programs remains small, relative to that of the state and federal governments, and the increase in local spending was smaller as well.

Figure 6. Changes in Who Pays for Alaska Health-Care, 2005-2010



Source: Authors' estimates

How About Health-Care Jobs?

This summary looks at health care from the perspective of spending for care—but it's important to remember that the spending also supports jobs for Alaskans. As the Alaska Department of Labor and Workforce Development reports in its August 2011 *Alaska Economic Trends*:

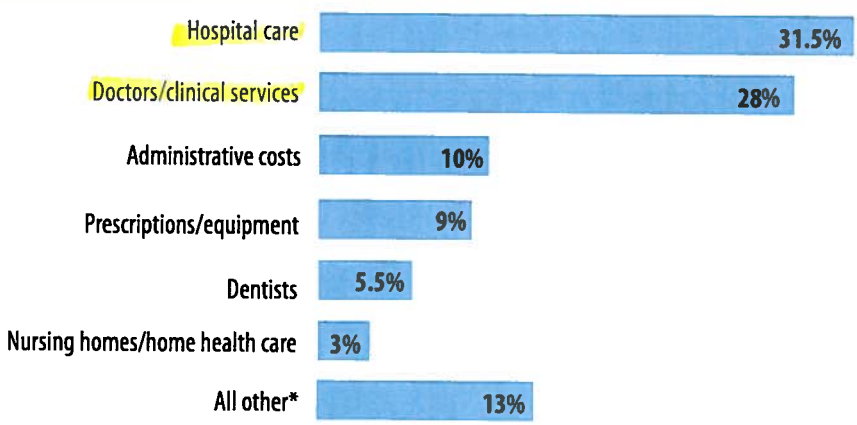
- Health-care spending directly supports 31,800 jobs in Alaska. That's one in ten of all wage and salary jobs—in hospitals, offices of doctors and other providers, nursing homes, and many other places.
- Many additional jobs related to health care—in government agencies, and among the self-employed—aren't included in that total.
- Alaska employment in health care has been increasing at an annual rate of 4.3% for the past decade.

What Do Health-Care Dollars Buy?

Alaska's $7.5 billion health-care bill includes everything from visits to doctors and dentists to prescriptions and nursing-home care.[5] Figure 7 summarizes what Alaska's health-care dollars bought in 2010.

- *Hospital care was the largest expense,* followed closely by payments for doctors and related clinical services—together they accounted for about 60% of Alaska health-care spending in 2010.
- *Administering private and public insurance plans cost one of every ten dollars* spent for Alaska health care in 2010. That's more than spending for prescriptions and medical equipment, and nearly twice the spending for dentists.
- *Spending for nursing homes and home-health care made up only about 3%* of total spending, even though spending for home health care has increased rapidly in the past decade. Much of this care is paid for under Medicaid.

Figure 7. What Do Alaska's Health-Care Dollars Buy?
(2010 Spending: $7.5 Billion)



*Other personal and professional care and public health activities.

Source: Mark A. Foster and Associates estimates, based on Centers for Medicare and Medicaid Services, National Health Expenditure accounts

Who Pays the Bills?

Individuals, private employers, and governments share the direct costs of health care in Alaska (Figure 1 and Table 1).

Individual Alaskans spent about $1.5 billion for health care in 2010—20% of total spending.

- *Alaskans with employer-based insurance—both private and government—paid about $640 million* for premiums, and those with individual policies spent $350 million.
- *Out-of-pocket costs for Alaskans totaled about $545 million* in 2010. That includes deductibles and co-pays—the part of medical bills insurance doesn't pay. It also includes costs for services not covered by insurance, and money that uninsured Alaskans spent for medical bills.

Private employers spent about $1.4 billion—18% of total spending.

- *Alaska businesses spent around $835 million to self-insure* in 2010. They set aside money to pay medical bills themselves, rather than pay insurance premiums. They're betting that the medical bills will be less than the premiums they would have paid—and that their reserves will be enough to cover annual variation in claims. Many self-insured firms carry "stop loss" insurance, to protect them against very large claims. At first only large firms self-insured, but as insurance costs climbed, smaller businesses have also begun self-insuring.
- *Businesses spent about $400 million for insurance premiums* in 2010. That's only about half what businesses spent to self-insure, showing how widespread the practice of self-insuring is.
- *Medical bills of employees injured at work cost businesses about $150 million* in 2010. State law requires employers to pay for such injuries.

Government employers spent $1.6 billion for health benefits in 2010.

- *Local government employers—including school districts—spent about $630 million,* the federal government nearly $590 million, and the state $410 million.
- *Like businesses, many public employers self-insure, rather than pay insurance premiums*—but we don't have enough data to separate out those costs. The federal government also pays medical costs for active-duty and retired military personnel and veterans.

Governments spent nearly $3 billion for health programs in 2010.

- *Medicaid spending was nearly $1.3 billion in 2010*—$871 million in federal money and $409 million in state money. Medicaid is a federal program, but the state administers it and shares the costs (see page 3).
- *Medicare spending was $733 million in 2010*, accounting for nearly 10% of all health-care spending. Medicare is a federal program for people 65 and older and those with certain disabilities. Medicare spending is expected to grow rapidly in the next decade, as older Alaskans make up an ever-growing share of the population (see page 5).
- *The federal government spent close to $650 million for other health programs* in 2010, including the Indian Health Service, which provides medical care for Alaska Natives, and the Veterans Administration, which provides care for military veterans. Spending for these programs depends somewhat on enrollment, but it's also constrained by Congressional appropriations.
- *Besides its share of Medicaid, the state government spent about $260 million* for a variety of other programs in 2010, including grants to local governments, the state-operated Pioneer Homes for older Alaskans, and the Alaska Psychiatric Institute.

Table 1. Health-Care Spending in Alaska, 2010
(Total Spending: $7.5 Billion)

Individuals	**$1,529 million**
Employee premiums	$637
Out-of-pocket costs	$544
Individual policies	$348
Private Employers*	**$1,384 million**
Insurance premiums	$395
Self-insurance costs	$836
Workers' compensation medical	$153
Government Employers*	**$1,625 million**
Federal	$586
State	$408
Local	$631
Federal Health Programs	**$2,250 million**
Medicare	$733
Medicaid	$871
IHS, VA, Community Health Centers, public health, K-12 health	$646
State Health Programs	**$670 million**
Medicaid	$409
Local grants, API, Pioneer Homes, K-12 health, WAMI, Department of Corrections	$261
Local Health Programs	**$45 million**
Hospital and health program support	$40
Other local	$5

*Includes coverage for current and retired employees.
Source: Authors' estimates. See page 12 for a description of what's included in health-care costs.

- *Local health programs are much smaller,* at around $45 million in 2010, largely support for hospitals and health programs.

And finally, keep in mind that even though governments and businesses pays most of the *direct* costs of health care, individual Alaskans and other Americans *indirectly* pay all the costs of health care—because they buy goods and services, own businesses, and pay taxes.

ALASKA ACTIVE AND RETIREE HEALTH PLAN DATA

HealthSmart
CARE MANAGEMENT SOLUTIONS

ACTIVE PLAN

4th Quarter Report 2013

Aggregate Risk Profile

Member Information			
Member Count	17338	Avg Forecasted Cost	$6,670
Avg Age	35	Avg Total Cost	$6,774
Percent Female	51%	Avg Forecasted Risk Index	1.09
Avg Months Enrolled	11	%/w Acute Impact Score >= 95	1.06%
		%/w Chronic Impact Score >= 95	5.38%
		%/w Motivation Rank >= 95	4.83%

Aggregate Risk Summary					
Risk Drivers	# Members	Avg Risk Contribution		Contribution to Forecast	Risk Contribution
Demographics	17338	SENIORS SKIN, FRACTURES, FALLS	$345	$5,987,784	5.18% X
Acute Respiratory Disorders	2880	TUBERCULOSIS	$1,129	$3,251,578	2.81% X
Arrhythmia Disorders	220		$3,382	$744,142	0.64%
CHF Conditions	673	CHRONIC HEART FAILURE	$3,181	$2,140,732	1.85% X
Cerebral Vascular Disorder	247		$4,199	$1,037,177	0.90%
Chronic Respiratory Disorders	1728	UPPER RESPIRATORY TRACT	$2,318	$4,005,542	3.46% X
Coronary Artery Related Conditions	1655	CORONARY HEART DISEASE	$2,958	$4,895,538	4.23% X
Dermatological Disorder	3075		$1,272	$3,911,805	3.38%
Diabetic Disorders	882	TYPE 1 AND TYPE 2	$5,932	$5,231,998	4.52% X
Female Reproductive Conditions	341	PRETERM BIRTHS	$2,510	$856,045	0.74% X
Gastrointestinal Disorders	2351	COLORECTAL CANCER	$2,011	$4,728,854	4.09% X
Heart Related Conditions	180		$5,628	$1,013,046	0.88%
Hypertension	1527	BLOOD PRESSURE	$1,983	$3,028,315	2.62% X
Hypotensive Drugs	1784		$2,207	$3,937,924	3.41%
Major Infection Related Conditions	2950	MRSA	$2,023	$5,968,497	5.16% X
Metabolic Conditions	3077	FIBROMYALGIA	$2,680	$8,247,421	7.13% X
Minor Infection Related Conditions	3704		$1,340	$4,965,037	4.29%
Miscellaneous Conditions	4750		$2,303	$10,940,696	9.46%
Musculo-skeletal Disorders	5173	INFANT MUSCLE, SENIOR FALLS	$2,206	$11,409,047	9.87% X
Myocardial Infarction Related Conditions	271		$5,315	$1,440,328	1.25%
Neonatal Issues	255	AUTISM, HEART PROGRAMMING	$935	$238,299	0.21% X
Neoplastic Related Conditions	638		$4,332	$2,763,900	2.39%
Neurological Disorder	3770	ALZHEIMER'S	$1,435	$5,409,047	4.68% X
Non-specific condition	5561		$140	$780,877	0.68%
Pneumonia	243	UPPER RESPIRATORY TRACT	$3,822	$928,744	0.80% X
Psychological Disorder	2688	S.A.D. AND DEPRESSION	$2,771	$7,447,883	6.44% X
Renal Disorders	309		$15,145	$4,679,794	4.05%
Trauma Related Condition	1822	TRAUMATIC BRAIN INJURY	$1,455	$2,651,019	2.29% X
Urinary Disorders	1381		$2,170	$2,996,360	2.59%

% total diseases directly related to Vitamin D status = 66.08 %

Notes in red by office of Rep. Seaton

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RETIREE PLAN

HealthSmart CARE MANAGEMENT SOLUTIONS

4th Quarter Report 2013

Aggregate Risk Profile

Member Information			
Member Count	65376	Avg Forecasted Cost	$15,666
Avg Age	63	Avg Total Cost	$17,726
Percent Female	54%	Avg Forecasted Risk Index	2.56
Avg Months Enrolled	12	%/w Acute Impact Score >= 95	5.47%
		%/w Chronic Impact Score >= 95	16.63%
		%/w Motivation Rank >= 95	9.70%

Aggregate Risk Summary					
Risk Drivers	# Members	Avg Risk Contribution		Contribution to Forecast	Risk Contribution
Demographics	65376	SENIORS SKIN, FRACTURES, FALLS	$454	$29,702,943	2.90% X
Acute Respiratory Disorders	9520	TUBERCULOSIS	$1,669	$15,893,121	1.55% X
Arrhythmia Disorders	5170		$2,860	$14,786,038	1.44%
CHF Conditions	10658	CHRONIC HEART FAILURE	$2,758	$29,389,999	2.87% X
Cerebral Vascular Disorder	5021		$3,726	$18,710,595	1.83%
Chronic Respiratory Disorders	11241	UPPER RESPIRATORY TRACT	$3,093	$34,763,411	3.39% X
Coronary Artery Related Conditions	24057	CORONARY HEART DISEASE	$2,900	$69,776,210	6.81% X
Dermatological Disorder	15979		$1,958	$31,281,265	3.05%
Diabetic Disorders	10689	TYPE 1 AND TYPE 2	$5,966	$63,771,119	6.23% X
Female Reproductive Conditions	103	PRETERM BIRTHS	$1,489	$153,413	0.01% X
Gastrointestinal Disorders	18753	COLORECTAL CANCER	$2,146	$40,246,314	3.93% X
Heart Related Conditions	4346		$4,374	$19,007,254	1.86%
Hypertension	21394	BLOOD PRESSURE	$1,623	$34,713,887	3.39% X
Hypotensive Drugs	21282		$1,869	$39,772,355	3.88%
Major Infection Related Conditions	13879	MRSA	$3,007	$41,731,745	4.07% X
Metabolic Conditions	28763	FIBROMYALGIA	$2,545	$73,213,862	7.15% X
Minor Infection Related Conditions	14339		$1,726	$24,754,410	2.42%
Miscellaneous Conditions	32888		$2,762	$90,833,634	8.87%
Musculo-skeletal Disorders	32886	INFANT MUSCLE, SENIOR FALLS	$2,498	$82,154,255	8.02% X
Myocardial Infarction Related Conditions	5796		$3,424	$19,844,208	1.94%
Neonatal Issues	63	AUTISM, HEART PROGRAMMING	$1,504	$94,751	0.01% X
Neoplastic Related Conditions	7447		$3,928	$29,253,071	2.86%
Neurological Disorder	27775	ALZHEIMER'S	$1,561	$43,366,164	4.23% X
Non-specific condition	12687		$113	$1,429,752	0.14%
Pneumonia	1619	UPPER RESPIRATORY TRACT	$5,098	$8,254,358	0.81% X
Psychological Disorder	16031	S.A.D. AND DEPRESSION	$2,659	$42,623,390	4.16% X
Renal Disorders	4750		$16,668	$79,174,484	7.73%
Trauma Related Condition	8749	TRAUMATIC BRAIN INJURY	$1,904	$16,660,268	1.63% X
Urinary Disorders	11515		$2,504	$28,836,425	2.82%

% total diseases directly related to Vitamin D status = 61.16%

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PRODUCTIVITY AT WORK

Impact of Vitamin D Deficiency on the Productivity of a Health Care Workforce

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Objective: To define the relationship between vitamin D status and employee presenteeism in a large sample of health care employees. **Methods:** Prospective observation study of 10,646 employees of a Midwestern-integrated health care system who completed an on-line health risk appraisal questionnaire and were measured for 25-hydroxyvitamin D. **Results:** Measured differences in productivity due to presenteeism were 0.66, 0.91, and 0.75 when comparing employees above and below vitamin D levels of 20 ng/mL, 30 ng/mL, and 40 ng/mL, respectively. These productivity differences translate into potential productivity savings of 0.191%, 0.553%, and 0.625%, respectively, of total payroll costs. **Conclusions:** Low vitamin D status is associated with reduced employee work productivity. Employee vitamin D assessment and replenishment may represent a low-cost, high-return program to mitigate risk factors and health conditions that drive total employer health care costs.

Learning Objectives

- Discuss the reasoning behind the suggestion that vitamin D deficiency may be a "fundamental risk factor" for reduced work productivity.
- Summarize the newly reported associations between vitamin D status and productivity, including the potential productivity savings for employees at different vitamin D levels.
- Review the study implications for employee health risk assessments and efforts to address risk factors for presenteeism and high health costs.

Employee health status significantly impacts workplace productivity and overall business performance.[1] Increasingly, employers are concerned not only with direct health care costs but also with indirect costs due to employee presenteeism, the state when employees are physically present at work but demonstrate reduced productivity and/or performance due to illness.[2] Presenteeism is financially significant: the cost to employers for presenteeism can exceed even the costs of pharmacy and medical utilization, illness-related absenteeism, or disability.[3] Presenteeism, not absenteeism or disability, accounts for the majority of lost productive time due to both pain conditions[4] and depression.[5] Surprisingly, for 18 common health conditions, presenteeism alone contributes 14% to 73% to total employer health care costs.[3] Presenteeism may cost US employers more than $150 billion per year.[6]

Presenteeism costs are not addressable by employer shifts to higher insurance co-pays and deductibles for both pharmacy and medical costs. The greatest opportunities to reduce presenteeism costs may come from employee health promotion programs such as health risk appraisals (HRAs), disease management programs, and behavior modification programs.[7] From these platforms, targeted investment in reduction of a fundamental risk factor among employees may deliver a powerful return through productivity gains.

Vitamin D deficiency may represent one such fundamental risk factor. Vitamin D deficiency is associated with the numerous conditions that can result in presenteeism,[8] including chronic nonspecific musculoskeletal pain,[9,10] low back pain,[11–13] allergic rhinitis,[14] arthritis,[15–18] asthma,[19–21] cancer,[22–26] depression,[27–30] diabetes,[31,32] gestational diabetes,[33] heart disease,[34,35] hypertension,[36,37] migraine/headache,[38] and respiratory disorders.[39–42] Additional associations related to impaired productivity may include impaired cognition,[43,44] falls,[45] and bone fractures.[46] For many of these conditions, there is an inverse relationship between vitamin D status and either disease activity or functional capacity.

Given these relationships, we hypothesized that vitamin D status may be associated with employee presenteeism. To test this hypothesis, we measured both vitamin D status and workplace productivity (presenteeism) across a large health care system as one part of an annual employee HRA.

METHODS

Participants

As part of an annual Employee Wellness campaign, 20,692 benefits-eligible employees of the Allina Health Care system in Minnesota and western Wisconsin were invited to complete an on-line HRA. Data were collected between January 1 and February 15, 2010. Respondents received $50 in compensation. Employees who completed the supplemental HRA and provided a blood sample to measure their vitamin D level between February 1 and April 1, 2010, were given a $25 gift card.The Allina Hospital and Clinics institutional review board reviewed and approved this protocol prior to any study procedures taking place.

Measures

As part of the HRA, respondents were asked their age, sex, height, weight, race, job classification, vitamin and dietary supplement intake, marital status, and medical history. The HRA also included the validated Workplace Productivity and Activity Impairment (WPAI) Questionnaire[47] that measures work limitations experienced in the prior 7 days as a result of physical or emotional health problems. The WPAI was created and has been used to measure the amount of presenteeism attributable to general health.[47]

All vitamin D measurements were performed at the Allina central laboratory using the LIAISON 25-OH Vitamin D Assay (DiaSorin, Inc, Stillwater, MN), a direct competitive chemiluminescence immunoassay for quantitative determination of total 25-OH

From the Center for Health Care Innovation and Penny George Institute for Health and Healing (Drs Plotnikoff and Dusek), Allina Hospitals and Clinics; and University of Minnesota Carlson School of Management (Dr Finch), Minneapolis, Minn.

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Diasorin Inc. had no role in the design and conduct of the study, the collection, management, analysis, and interpretation of the data, or the preparation or approval of the manuscript.

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Midwestern Health Care System Employees in Study **= 10,646 workers**

Estimated Employer Health Care Costs Due to Diminished Employee Productivity from Illness **= 15% to 73%, or more than $150 Billion Per Year**

Active State Employees: **17,338**

Estimated Savings for Above 20 ng/mL of Vit. D Compared to Below 20 ng/mL

= $112 Per Employee Per Year *or* total of $1.9 Million Per Year

Estimated Savings for Above 40 ng/mL of Vit. D Compared to Below

= $370 Per Employee Per Year *or* total of $6.4 Million Per Year

ECONOMIC BURDENS TO THE U.S. DUE TO INSUFFICIENT SOLAR ULTRAVIOLET IRRADIANCE

Photochemistry and Photobiology, 2005, 81: 1276–1286

Symposium-in-Print
UV Radiation, Vitamin D and Human Health: An Unfolding Controversy

Comparisons of Estimated Economic Burdens due to Insufficient Solar Ultraviolet Irradiance and Vitamin D and Excess Solar UV Irradiance for the United States

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ABSTRACT

Vitamin D sufficiency is required for optimal health, and solar ultraviolet B (UVB) irradiance is an important source of vitamin D. UVB and/or vitamin D have been found in observational studies to be associated with reduced risk for over a dozen forms of cancer, multiple sclerosis, osteoporotic fractures, and several other diseases. On the other hand, excess UV irradiance is associated with adverse health outcomes such as cataracts, melanoma, and nonmelanoma skin cancer. Ecologic analyses are used to estimate the fraction of cancer mortality, multiple sclerosis prevalence, and cataract formation that can be prevented or delayed. Estimates from the literature are used for other diseases attributed to excess UV irradiation, additional cancer estimates, and osteoporotic fractures. These results are used to estimate the economic burdens of insufficient UVB irradiation and vitamin D insufficiency as well as excess UV irradiation in the United States for these diseases and conditions. We estimate that 50 000–63 000 individuals in the United States and 19 000–25 000 in the UK die prematurely from cancer annually due to insufficient vitamin D. The U.S. economic burden due to vitamin D insufficiency from inadequate exposure to solar UVB irradiance, diet, and supplements was estimated at $40–56 billion in 2004, whereas the economic burden for excess UV irradiance was estimated at $6–7 billion. These results suggest that increased vitamin D through UVB irradiance, fortification of food, and supplementation could reduce the health care burden in the United States, UK, and elsewhere. Further research is required to confirm these estimates.

INTRODUCTION

There is rapidly mounting evidence that vitamin D has many important health benefits and that adequate serum levels of 25-hydroxyvitamin D (25(OH)D) are required for optimal health (1–12). There are also studies indicating that solar ultraviolet B (UVB) exposure is the primary source of vitamin D for most people outside the near-polar regions (13). However, despite this evidence, public health leaders have been slow to accept the role of solar UVB irradiance and vitamin D in maintaining optimal health, in part, because of widespread concern regarding the risk of cutaneous malignant melanoma (CMM) and nonmelanoma skin cancer (NMSC) due to solar UV irradiance.

In this study, we estimate the economic burden of insufficient solar UVB irradiance and vitamin D in the United States and compare this estimate with the economic burden from excess UV irradiation over either short (sunburning) or long periods. The approach is to consider diseases for which a strong geographic variation in the United States can be identified for disease outcome and to then use these variations to estimate the fraction of the disease burden in the United States that can be attributed to insufficient UVB irradiance and/or vitamin D or to excess solar UV irradiance. For some diseases that are linked to vitamin D deficiency but for which geographical variations are not apparent within the United States, results in the literature are used. Following that, the results for the United States are extrapolated to the United Kingdom.

MATERIALS AND METHODS

The diseases for which economic burdens due to insufficient solar UVB irradiance and/or vitamin D are estimated are cancer, multiple sclerosis

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Abbreviations: B, billion (10^9); CMM, cutaneous malignant melanoma; KC, Korean Conflict; M, million (10^6); MR, mortality rates; MS, multiple sclerosis; NMSC, nonmelanoma skin cancer; RR, risk reduction; SPF, sun protection factor; SUNARC, Sunlight, Nutrition and Health Research Center; Th1, T helper cells 1; UVA, ultraviolet A (315–400 nm); UVB, ultraviolet B (290–315 nm); UVR, ultraviolet radiation (290–400 nm); VDR, vitamin D receptors; WWII, World War II; $1,25(OH)_2D_3$, 1,25-dihydroxy vitamin D_3; 25(OH)D, 25-hydroxyvitamin D.

2004 Estimated US Economic Burden Due to Vitamin D Insufficiency from Solar UVB Irradiance and Vit. D Intake **= $40 - $56 Billion**

2004 Estimated US Economic Burden Due to Excess UV Irradiance **= $6 - $7 Billion**

Estimated Per Year Savings with Sufficient Vitamin D for the United States

= $34 - $49 Billion

BENEFITS OF VITAMIN D FOR GERMANY

REVIEW

The estimated benefits of vitamin D for Germany

A. Zittermann

Clinic for Thoracic and Cardiovascular Surgery, Heart Center North Rhine-Westphalia, Ruhr University Bochum, Bad Oeynhausen, Germany

This article gives an overview of the vitamin D status in Germany, provides evidence for an independent association of vitamin D deficiency with various chronic diseases, and discusses preventive measures for improving vitamin D status in Germany. The prevalence of vitamin D insufficiency is 40–45% in the general German population. An additional 15–30% are vitamin D deficient. Vitamin D can prevent falls and osteoporotic fractures in older people. There is also accumulating evidence that vitamin D may prevent excess mortality and may probably prevent some chronic diseases that occur in early life such as type 1 diabetes and multiple sclerosis. Adherence to present sun safety policy (avoidance of the sun between 11 am and 3 pm) and dietary recommendations (5–10 μg daily for adults) would, however, definitively lead to vitamin D deficiency. The estimated cost saving effect of improving vitamin D status in Germany might be up to 37.5 billion € annually. It should be the goal of nutrition and medical societies to erase vitamin D deficiency in Germany within the next 5–10 years. To achieve this goal, the daily production of at least 25 μg of vitamin D in the skin or an equivalent oral intake should be guaranteed.

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Keywords:
Costs / Mortality / Survival / Ultraviolet radiation / Vitamin D

1 Introduction

Vitamin D is well known for its effects on calcium and bone metabolism. Vitamin D deficiency results in rickets in infants and small children and in osteomalacia and osteoporosis in adults. However, it is becoming increasingly clear that vitamin D has a much broader range of actions in the human body than believed before. The vitamin D receptor is nearly ubiquitously expressed, and almost all cells respond to vitamin D exposure; about 3% of the human genome is regulated, directly and/or indirectly, by the vitamin D endocrine system [1]. Consequently, vitamin D influences many physiological processes, including muscle function, cardiovascular homeostasis, nervous function, cellular integrity, and the immune response [2]. It is easy to imagine that severe disturbances in these biological systems have serious health effects. The present article gives an overview of the vitamin D status in Germany, provides evidence for an independent association of vitamin D deficiency with chronic diseases, and discusses preventive measures for improving vitamin D status in Germany.

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Abbreviation: RCT, randomized controlled trial

2 Vitamin D metabolism

Solar UVB radiation (290–315 nm) is the major source of vitamin D for humans, whereas dietary vitamin D is a second, less important source. Already, 20 min of a daily whole body exposure to UVB radiation trice a week is able to maintain adequate vitamin D status in people with light skin [3]. However, increased skin pigment can increase exposure time by factor six to achieve a similar effect [4]. Unfortunately, Germany has only a moderate climate and its geographic location (47°16'N to 55°04'N) is relatively northern. Generally, solar UV-B radiation is assumed to be negligible at geographic latitude of 40°N from November until February and at latitude of 50°N from October until April [5].

The UV-index for Rinteln, a small town in Central Germany (geographic latitude: 52°N), is illustrated in Fig. 1

German Population of **82 Million**

Estimated 38 Billion € Saved Annually

HOWEVER;

Assumption: Estimated 20,000 individuals survive premature death annually due to Vit. D intake, each individual would receive pension of 20,000€ annually.

Reduction of 0.5 Billion €

Total Annual Cost Savings in Germany

by Improving Vitamin D to

100 nmol/L (42 ng/mL)

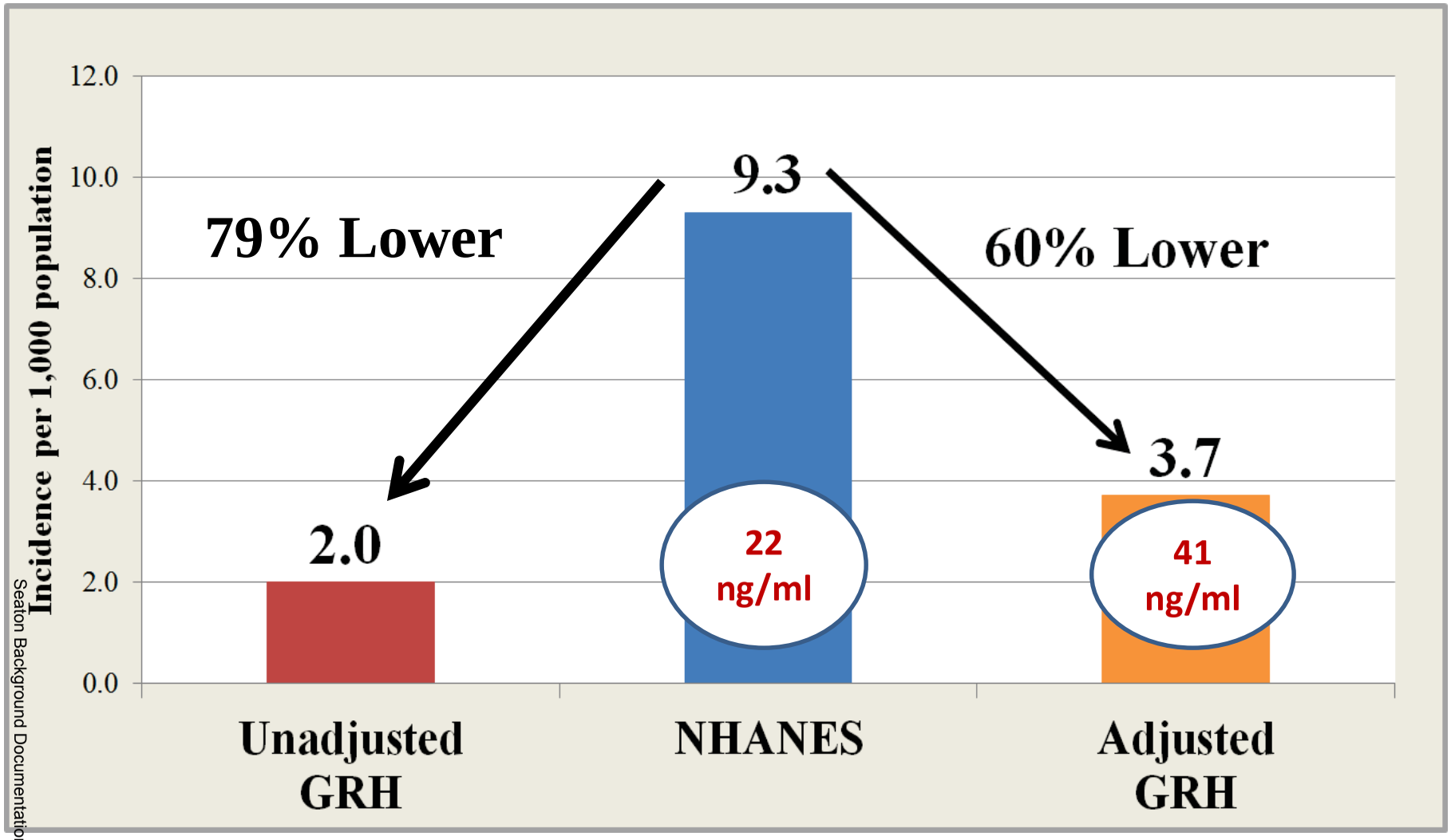
= 37.5 Billion €

Or

€ 457 per person

DIABETES COST

Type 2 Diabetes Incidence in GrassrootsHealth (N=4,933) and NHANES (N=4,078) Cohorts (age 20 and above)



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Median 25 (OH)D concentration in GRH cohort was 41 ng/ml and in NHANES was 22 ng/ml

(Notes by Rep Seaton)

Diabetes Care. 2013 May; 36(5):1422-8

Full text available at http://care.diabetesjournals.org/content/36/5/1422.full

Blood 25-Hydroxy Vitamin D Levels and Incident Type 2 Diabetes

A meta-analysis of prospective studies

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Next Section

Abstract

OBJECTIVE To quantitatively assess the strength and shape of the association between blood 25-hydroxy vitamin D [25(OH)D] levels and incident risk of type 2 diabetes.

RESEARCH DESIGN AND METHODS A systematic search of the MEDLINE and Embase databases and a hand search of references from original reports were conducted up to 31 October 2012. Prospective observational studies that assessed the association between blood levels of 25(OH)D and risk of incident type 2 diabetes were included for meta-analysis. DerSimonian and Laird's random-effects model was used. A quadratic spline regression analysis was used to examine the shape of the association with a generalized least-squares trend test performed for the dose-response relation.

RESULTS A total of 21 prospective studies involving 76,220 participants and 4,996 incident type 2 diabetes cases were included for meta-analysis. Comparing the highest to the lowest category of 25(OH)D levels, the summary relative risk for type 2 diabetes was 0.62 (95% CI 0.54–0.70). A spline regression model showed that higher 25(OH)D

38% Lower Risk of Type 2 with higher vitamin D

Active State Of Alaska employees, Retirees and dependents – **83,000**

Employees, Retirees and dependents minus those with Diabetes already – **71,143**

New incidences of diabetes per year – **8.5 per 1,000 per year (.0085)**

Average cost of annual medical expenditures directly attributable to diabetes – **$7,900**

=

Current Diabetes Cost per year= **$4,777,252**

Per year Savings at 90% reduction = $4,299,527

(GrassrootsHealth D*Action study)

Per year Savings at 38% reduction = $1,815,356

(Meta-analysis of prospective studies - Song et.al.)

COLORECTAL CANCER

VOLUME 29 · NUMBER 28 · OCTOBER 1 2011

JOURNAL OF CLINICAL ONCOLOGY

ORIGINAL REPORT

Association Between Vitamin D and Risk of Colorectal Cancer: A Systematic Review of Prospective Studies

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Authors' disclosures of potential conflicts of interest and author contributions are found at the end of this article.

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0732-183X/11/2928-3775/$20.00

DOI: 10.1200/JCO.2011.35.7566

ABSTRACT

Purpose
To conduct a systematic review of prospective studies assessing the association of vitamin D intake or blood levels of 25-hydroxyvitamin D [25(OH)D] with the risk of colorectal cancer using meta-analysis.

Methods
Relevant studies were identified by a search of MEDLINE and EMBASE databases before October 2010 with no restrictions. We included prospective studies that reported relative risk (RR) estimates with 95% CIs for the association between vitamin D intake or blood 25(OH)D levels and the risk of colorectal, colon, or rectal cancer. Approximately 1,000,000 participants from several countries were included in this analysis.

Results
Nine studies on vitamin D intake and nine studies on blood 25(OH)D levels were included in the meta-analysis. The pooled RRs of colorectal cancer for the highest versus lowest categories of vitamin D intake and blood 25(OH)D levels were 0.88 (95% CI, 0.80 to 0.96) and 0.67 (95% CI, 0.54 to 0.80), respectively. There was no heterogeneity among studies of vitamin D intake ($P = .19$) or among studies of blood 25(OH)D levels ($P = .96$). A 10 ng/mL increment in blood 25(OH)D level conferred an RR of 0.74 (95% CI, 0.63 to 0.89).

Conclusion
Vitamin D intake and blood 25(OH)D levels were inversely associated with the risk of colorectal cancer in this meta-analysis.

33% Lower Risk

J Clin Oncol 29:3775-3782. © 2011 by American Society of Clinical Oncology

INTRODUCTION

25-hydroxyvitamin D [25(OH)D] is the precursor of the physiologically active form of vitamin D. The serum level of 25(OH)D is a result of exposure of the skin to sunlight, total vitamin D intake, and other factors such as age and skin pigmentation.[1-2] Vitamin D has the ability to inhibit cell proliferation and increase apoptosis in vitro, and several tissues can locally produce the physiologically active form of vitamin D, which has anticarcinogenic properties.[3-6] In addition, many cell types, including colorectal epithelial cells, contain vitamin D receptors. These cells are able to convert the circulating 25(OH)D into active 1 to 25(OH)D metabolites, which in turn bind to the cells' own vitamin D receptors to produce an autocrine effect by inducing cell differentiation and inhibiting proliferation, invasiveness, angiogenesis, and metastatic potential.[7] Therefore, low vitamin D levels may increase the risk of colorectal cancer through the above potential mechanism. Currently, vitamin D deficiency is an important health problem in the industrial world[8-9]; in the United States, 25% to 58% of adolescents and adults are deficient in vitamin D.[10]

The results from prospective studies that have examined the association between vitamin D intake or 25(OH)D levels in the blood and the risk of colorectal cancer have been inconsistent. The aim of this review was to evaluate the evidence from prospective studies on vitamin D intake or blood levels of 25(OH)D and the risk of colorectal cancer by summarizing it quantitatively with a meta-analysis approach.

METHODS

Search Strategy

The literature search was conducted before October 2010 in the MEDLINE and EMBASE databases without restrictions and included articles ahead of publication. The following keywords were used in searching: "vitamin D or 25(OH)D" and "colorectal cancer or colon cancer or rectal cancer." Moreover, we searched

NOTE: Colorectal Cancer death rates in the Alaska Native community are nearly double the Alaska and U.S. Baseline population - Healthy Alaskans 2010 - DHSS

Optimal Vitamin D Status for Colorectal Cancer Prevention: A Quantitative Meta-Analysis
Edward D. Gorham, MPH, et. al. Am J Prev Med 2007;32(3)

Meta-analysis

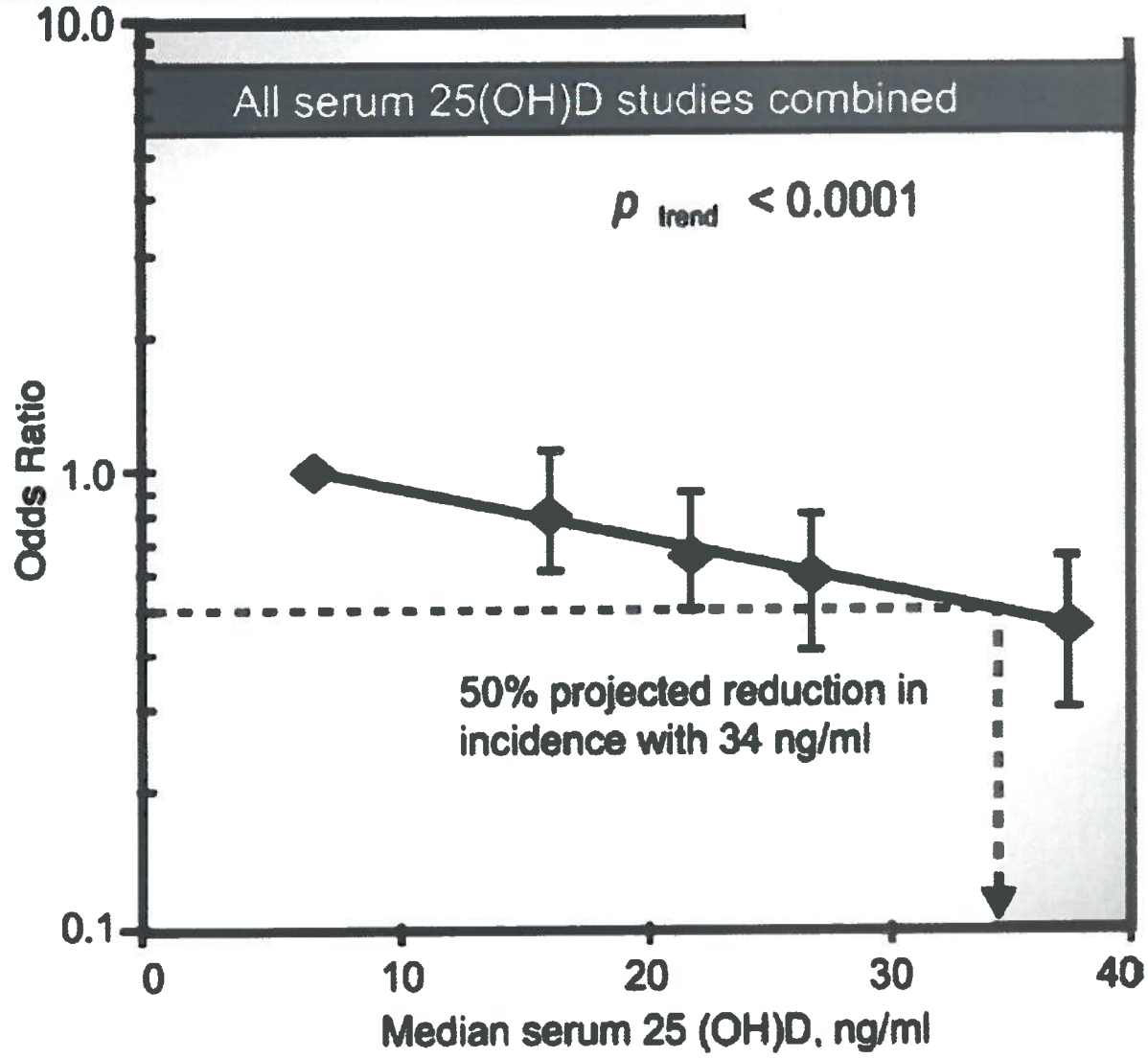

Figure 1. Dose–response gradient for colorectal cancer according to serum 25(OH)D concentration, all five studies combined.[1,4–7] The five points are the odds ratios for each quintile of 25(OH)D based on combined data from the five studies.

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Active State Of Alaska employees, Retirees and dependents – **83,000**

Incidence of Colorectal Cancer per year in AK - **43 per 100,000 (.0043)**

Average cost of annual medical expenditures directly attributable to Colon Cancer – **$11,000**

=

AK State Cost for Colorectal Cancer per year **$ 3,925,900**

50% per year savings with vitamin D

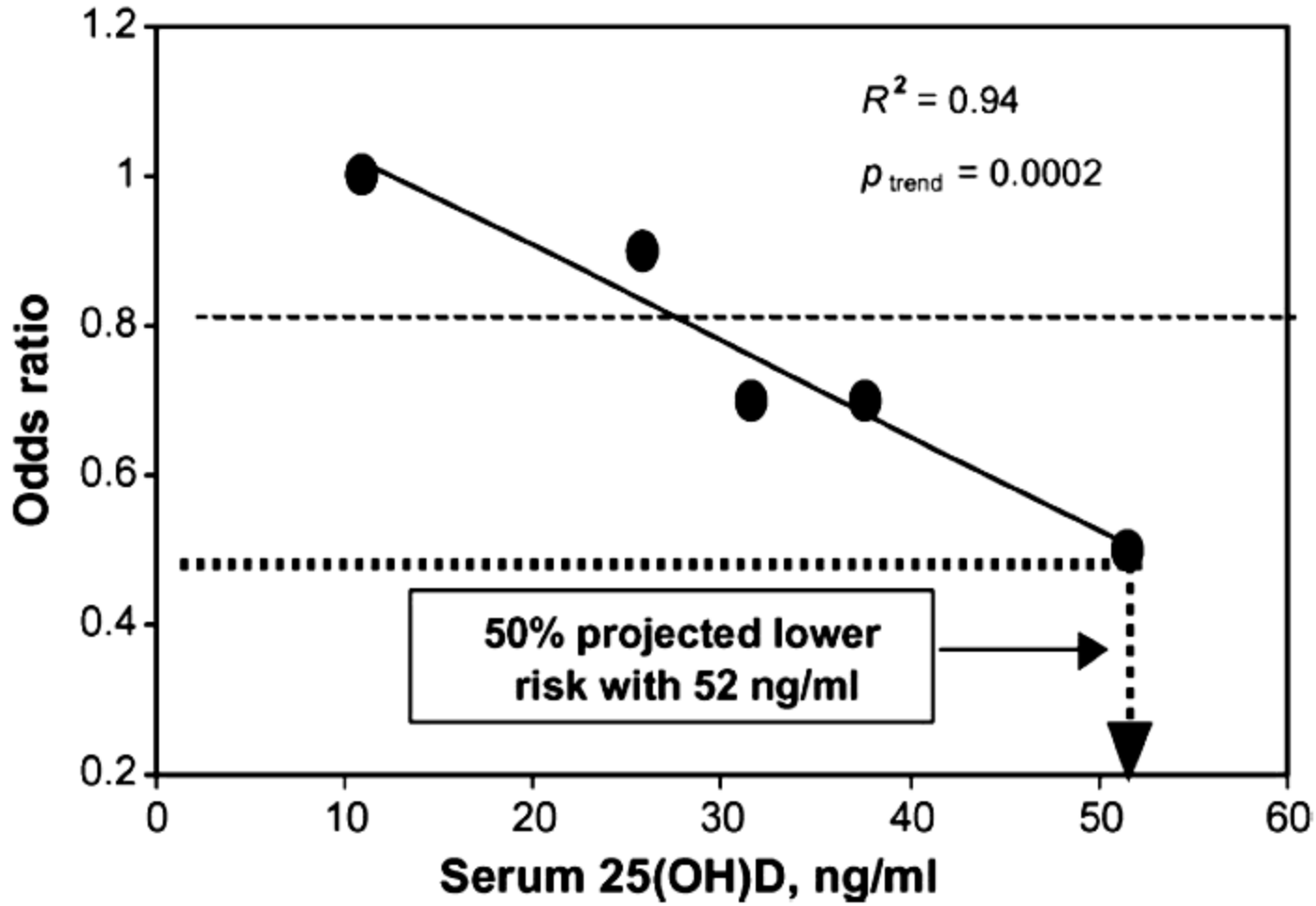
$1,962,950

(meta-analysis Gorham et. al.)

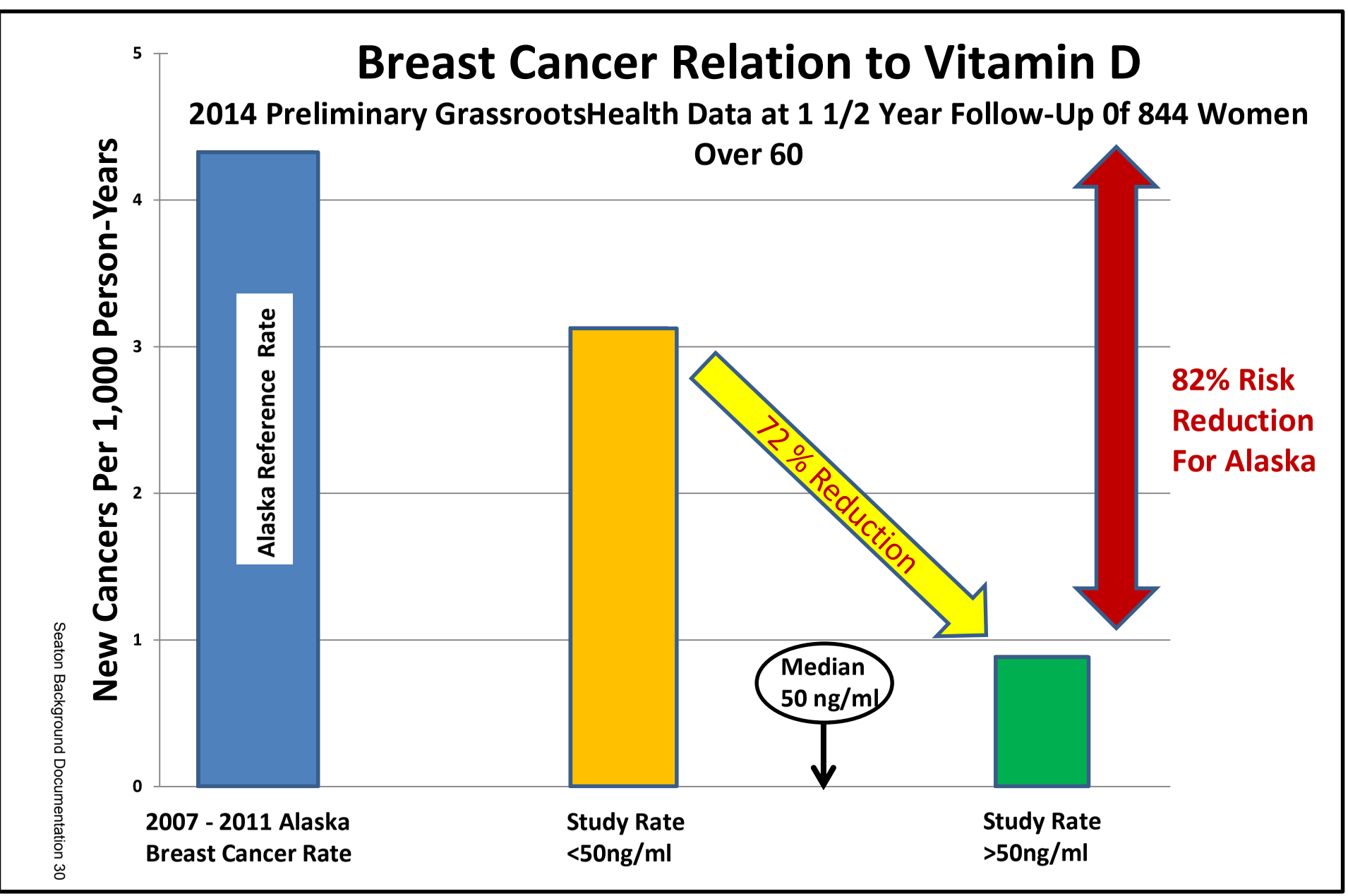
BREAST CANCER

Meta-analysis of breast cancer risk

[Slide by Cedric F. Garland, et al. University of California San Diego]



Dose–response gradient of risk of breast cancer according to serum 25-hydroxyvitamin D concentration, pooled analysis.



Hazard ratio of breast cancer for those with serum 25(OH)D <50ng/ml was 5.1 times more compared to those with ≥ 50ng/ml, adjusting for age and BMI. Chart arranged by the office of Representative Seaton

Active State Of Alaska employees, Retirees and dependents **- 83,000**

Female percentage of AK employees and retirees: 53% = 43,990

Incidence of Breast Cancer per year in AK - **125 per 100,000 (.0125)**

Average cost of annual medical expenditures directly attributable to Breast Cancer - **$11,000**

=

Per year AK State Cost for Breast Cancer: $**6,048,625**

50% reduction with vitamin D
Per Year Savings with vitamin D:

$3,024,312

72% reduction with vitamin D (2014 GRH study)

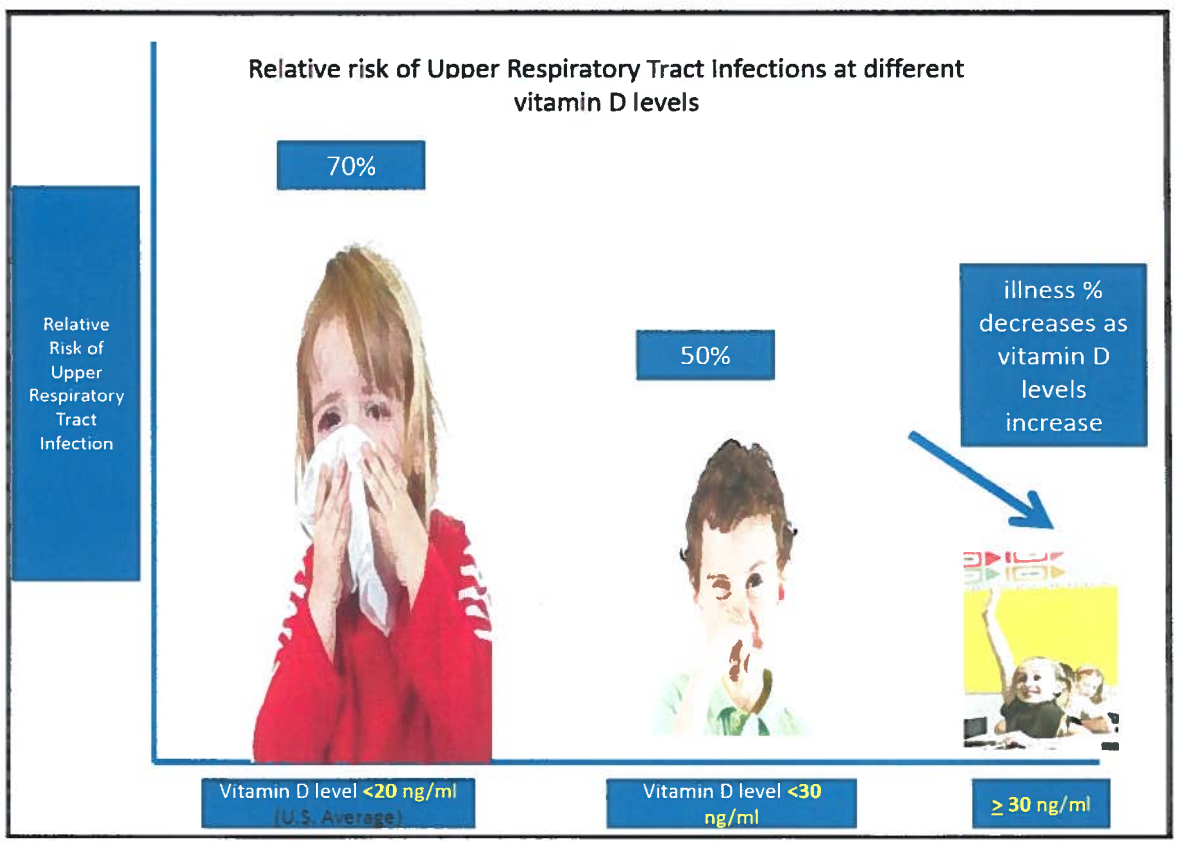
Per Year Savings with Vitamin D:

$4,355,010

UPPER RESPIRATORY TRACT INFECTIONS

Upper Respiratory Tract Infections

Recently, a study was conducted with seven hundred forty-three children ages 3-15 in a Canadian Hutterite Community. **The findings of the study show that children with higher vitamin D blood levels had a 50% lower relative risk of contracting an Upper Respiratory Tract infection.** Those children at the United States national average of 21 ng/ml vitamin D levels were at a 70% greater risk of contracting respiratory infections. Illnesses such as RTI's are commonly a factor in children's absences from school. Making sure your child has sufficient vitamin D will not only increase their health, but will lead to less school absences due to illness.



Low Serum 25 Hydroxyvitamin D level and Risk of Upper Respiratory tract infection in Children and Adolescents Science et. al. Journal of Clinical Infectious Diseases, August 2013 volume 57.

Prepared by the office of Representative Paul Seaton

BMJ open accessible medical research

Vitamin D_3 supplementation in patients with frequent respiratory tract infections: a randomised and double-blind intervention study

Peter Bergman,[1,2,3] Anna-Carin Norlin,[2,4] Susanne Hansen,[2] Rokeya Sultana Rekha,[5] Birgitta Agerberth,[5] Linda Björkhem-Bergman,[6] Lena Ekström,[6] Jonatan D Lindh,[6] Jan Andersson[3]

To cite: Bergman P, Norlin A-C, Hansen S, *et al*. Vitamin D_3 supplementation in patients with frequent respiratory tract infections: a randomised and double-blind intervention study. *BMJ Open* 2012;**2**: e001663. doi:10.1136/bmjopen-2012-001663

► Prepublication history and additional material for this paper are available online. To view these files please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2012-001663).

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PB and ACN contributed equally to this study.

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ABSTRACT

Background: Low serum levels of 25-hydroxyvitamin D_3 are associated with an increased risk of respiratory tract infections (RTIs). Clinical trials with vitamin D_3 against various infections have been carried out but data are so far not conclusive. Thus, there is a need for additional randomised controlled trials of effects of vitamin D_3 on infections.

Objective: To investigate if supplementation with vitamin D_3 could reduce infectious symptoms and antibiotic consumption among patients with antibody deficiency or frequent RTIs.

Design: A double-blind randomised controlled trial.

Setting: Karolinska University Hospital, Huddinge.

Participants: 140 patients with antibody deficiency (selective IgA subclass deficiency, IgG subclass deficiency, common variable immune disorder) and patients with increased susceptibility to RTIs (>4 bacterial RTIs/year) but without immunological diagnosis.

Intervention: Vitamin D_3 (4000 IU) or placebo was given daily for 1 year.

Primary and secondary outcome measures: The primary endpoint was an infectious score based on five parameters: symptoms from respiratory tract, ears and sinuses, malaise and antibiotic consumption. Secondary endpoints were serum levels of 25-hydroxyvitamin D_3, microbiological findings and levels of antimicrobial peptides (LL-37, HNP1–3) in nasal fluid.

Results: The overall infectious score was significantly reduced for patients allocated to the vitamin D group (202 points) compared with the placebo group (249 points; adjusted relative score 0.771, 95% CI 0.604 to 0.985, p=0.04).

Limitations: A single study centre, small sample size and a selected group of patients. The sample size calculation was performed using p=0.02 as the significance level whereas the primary and secondary endpoints were analysed using the conventional p=0.05 as the significance level.

Conclusions: Supplementation with vitamin D_3 may reduce disease burden in patients with frequent RTIs.

ARTICLE SUMMARY

Article focus

- Recent evidence suggests that vitamin D_3 has potent extraskeletal effects, such as suppression of inflammation and strengthening of mucosal immunity by induction of antimicrobial peptides.
- Data from observational studies suggest that low levels of 25-hydroxyvitamin D_3 are associated with an increased risk of respiratory tract infections.
- Results from a limited number of randomised controlled trials on the protective role of vitamin D_3 against respiratory tract infections are inconclusive and thus additional studies are warranted.

Key messages

- Therefore we designed and carried out a randomised controlled trial where a large dose (4000 IU) of vitamin D_3 was given to patients with an increased susceptibility to infections for 1 year.
- The main conclusion is that vitamin D_3 supplementation reduces symptoms and antibiotic consumption among patients with an increased frequency of respiratory tract infections. Thus, vitamin D_3 supplementation may be an alternative strategy to reduce antibiotic use among patients with recurrent respiratory tract infections.

Strengths and limitations of this study

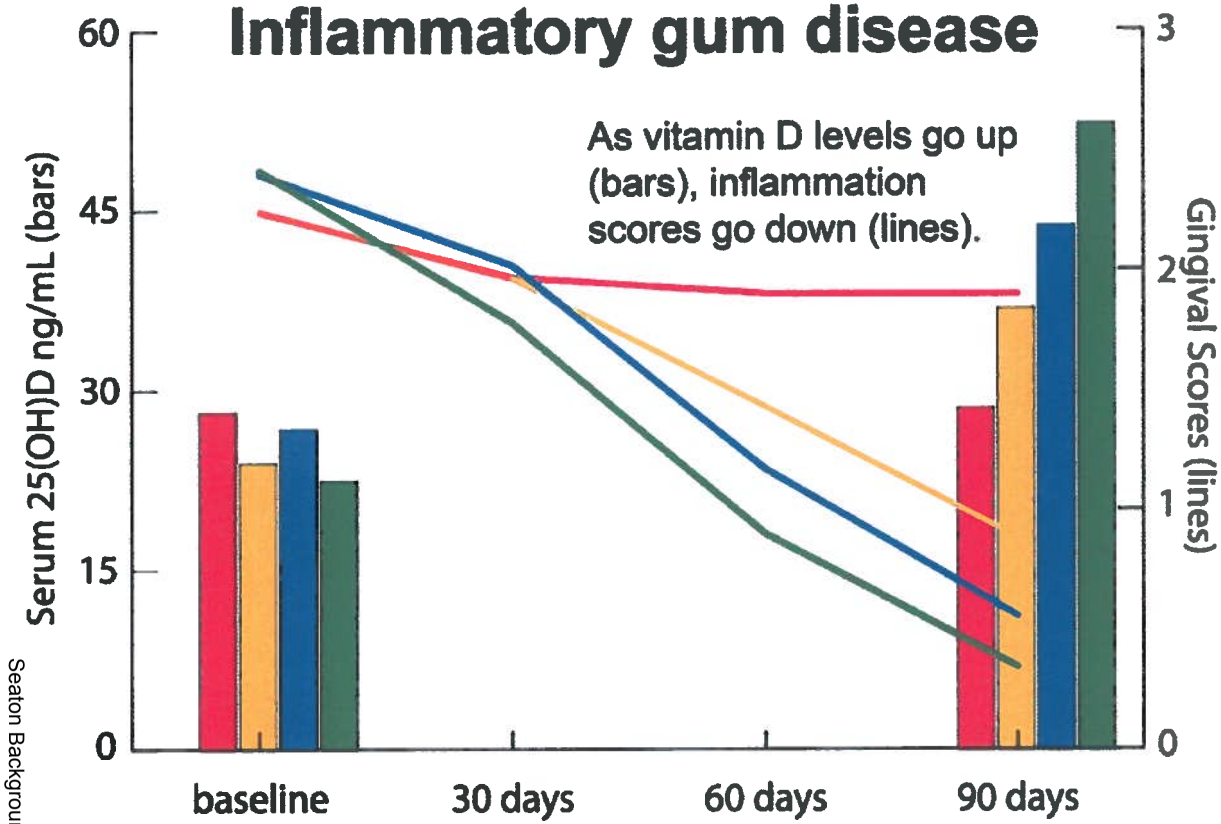
- A high daily dose of vitamin D_3 was used, the study time was a full year covering all seasons and patients with an increased frequency of respiratory tract infections were studied.
- A single study centre, small sample size (n=140) and a selected group of patients.

INTRODUCTION

Vitamin D was discovered when it was noted that rachitic children were improved by exposure to sunlight.[1] It was later shown by Holick *et al*[2] that vitamin D_3 is synthesised in the skin under the influence of ultraviolet light. Vitamin D_3 is further hydroxylated in the liver

INFLAMMATION

Inflammatory gum disease



0 IU (placebo)	After 3 months
500 IU/day	More than 50% reduction
1000 IU/day	More than 65% reduction
2000 IU/day	More than 80% reduction

Hiremath VP, Rao CB, Naik V, Prasad KVV. Anti-inflammatory Effect of Vitamin D on Gingivitis: A Dose-Response Randomised Control Trial. Oral Health Prev. Dent. 2013; 11(1):61-69. (notes by Seaton)

SENIOR FALLS AND FRACTURES

Vitamin D project helps prevent falls and saves health costs

Published By Live News / August 8, 2013 / No Comments

Source: New Zealand Government – Press Release/Statement:

Headline: Vitamin D project helps prevent falls and saves health costs

Associate Minister of Health Jo Goodhew says MidCentral DHB's vitamin D project is a good example of how a simple intervention can improve lives and save health dollars.

In 2010 the DHB, in partnership with ACC, began encouraging health professionals to prescribe vitamin D to residents in aged care facilities. Between March 2010 and June 2012 the uptake of vitamin D by aged care residents increased from 15 to 74 per cent.

"Comparisons from before and after the start of the project show a 32 per cent reduction in aged residential care residents going to the emergency department with falls-related fractures, and a 41 per cent reduction in their hospital admissions due to these fractures." Mrs Goodhew said.

"The benefits of preventing falls in older people cannot be overstated. Preventing falls enables older people to maintain their independence and confidence.

"Of older people who suffer a hip fracture, nearly 20 per cent will die within a year. Almost half will require long-term care and half will require help at home. Half of those who walked without help before fracturing a hip will be unable to walk without assistance in the year following the fracture."

The vitamin D project is also estimated to have saved MidCentral DHB more than $540,000 because of fewer people coming to the emergency department and reduced admissions to hospital. Further savings are also likely because of reduced need for clinical support, hospital pharmacy services, and physiotherapy and rehabilitation services.

International evidence shows that taking vitamin D significantly reduces older adults' risk of falling.

"We know older people are less likely to fall and injure themselves if they keep their muscles and bones in good condition.

Vitamin D has been shown to increase the number and size of type II muscle fibres, which play an important role in balance and mobility. Vitamin D also helps maintain bone strength," MidCentral DHB pharmacy advisor Andrew Orange says.

The Health Quality & Safety Commission's national patient safety campaign *Open for better care* is currently focusing on falls prevention. For more information about the *Open* campaign, go to www.open.hqsc.govt.nz.