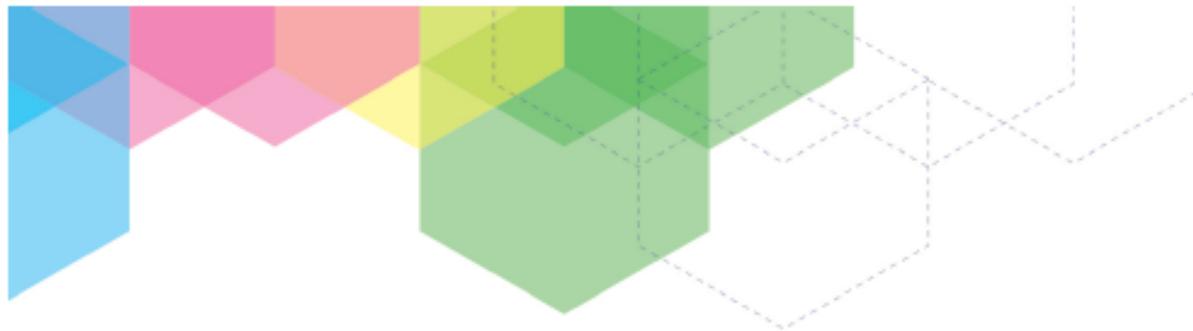


科学から経済へ

- サプリメントの想定可能な価値



**Micronutrient challenges and opportunities:
Where do we stand?**

**Manfred Eggersdorfer, PhD
Professor for Healthy Ageing**

FROM SCIENCE TO ECONOMICS
THE POTENTIAL VALUE OF SUPPLEMENTATION

IADSA
International Alliance of Dietary/
Food Supplement Associations

**微量栄養素による挑戦と機会：
現状は？**

Manfred Eggersdorfer, PhD
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Micronutrient challenges and opportunities: Where do we stand?

- Inadequate micronutrient intake is a global issue
- Opportunities: Case studies
 - Vitamin D
 - Vitamin C
 - Omega-3
- Challenges in micronutrients
- Summary and outlook

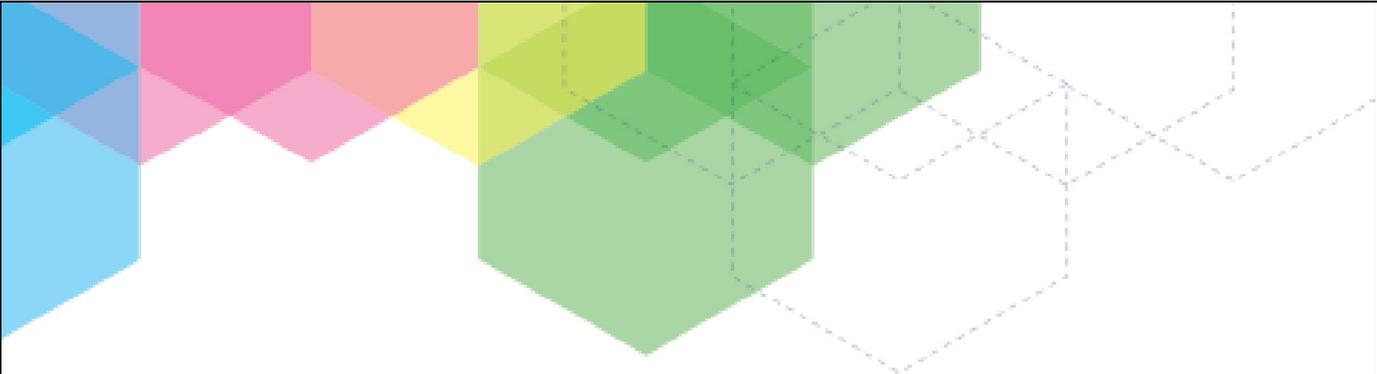
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微量栄養素による挑戦と機会：現状は？

- 微量栄養素の摂取量が不適切であることは、世界的な課題
- 機会：事例研究
- ビタミンD
- ビタミンC
- オメガ-3
- 微量栄養素における挑戦
- 要約と今後の展望



Do we need nutritional ingredients?

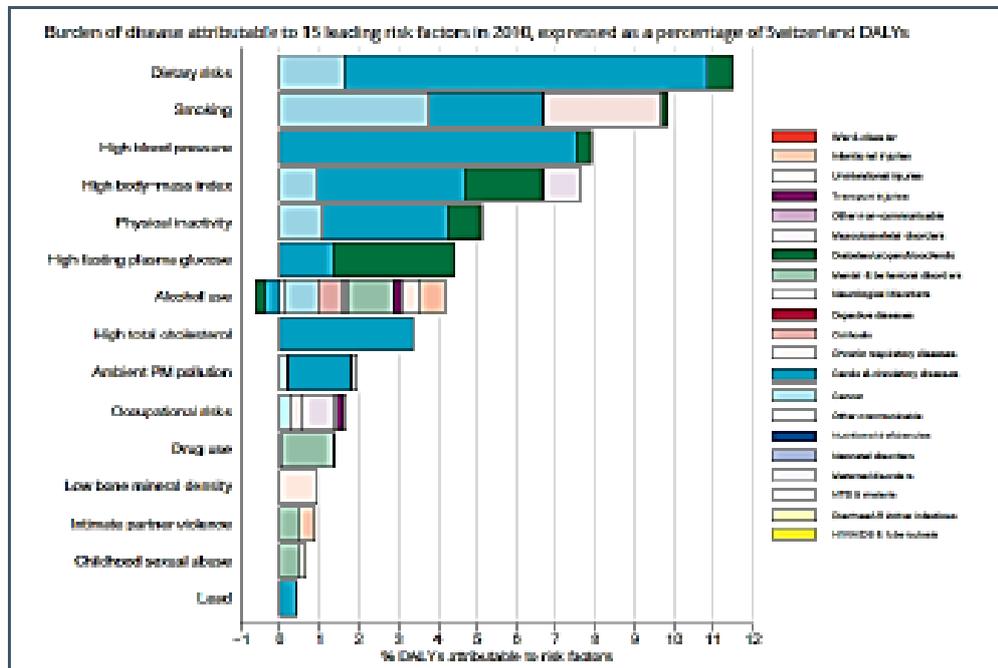
Do we need supplements?

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栄養成分は必要か？
サプリメントは必要か？

Dietary risks are the key risk factor for mortality Example Switzerland



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食事によるリスクは、死亡率に 関する重要なリスク因子である

- スイスの例
- 2010年のスイスにおけるDALYsを、疾病罹患に関与するトップ15のリスク因子におけるリスク率。

Adequate micronutrient intake is an issue in Western countries



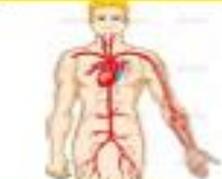
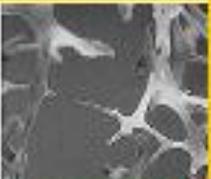
Troesch et al BJJN 2012

適切な微量栄養素の摂取量確保は、欧米諸国における課題である

- ドイツ
- 米国
- 英国
- オランダ

Inadequate micronutrient intake affects long term health and performance

Nutrient status Metabolic response

Desirable	Long term health, wellness, vitality			
Insufficient	Impaired functions, higher risk for non-communicable diseases			
Deficient	Deficiency disease			

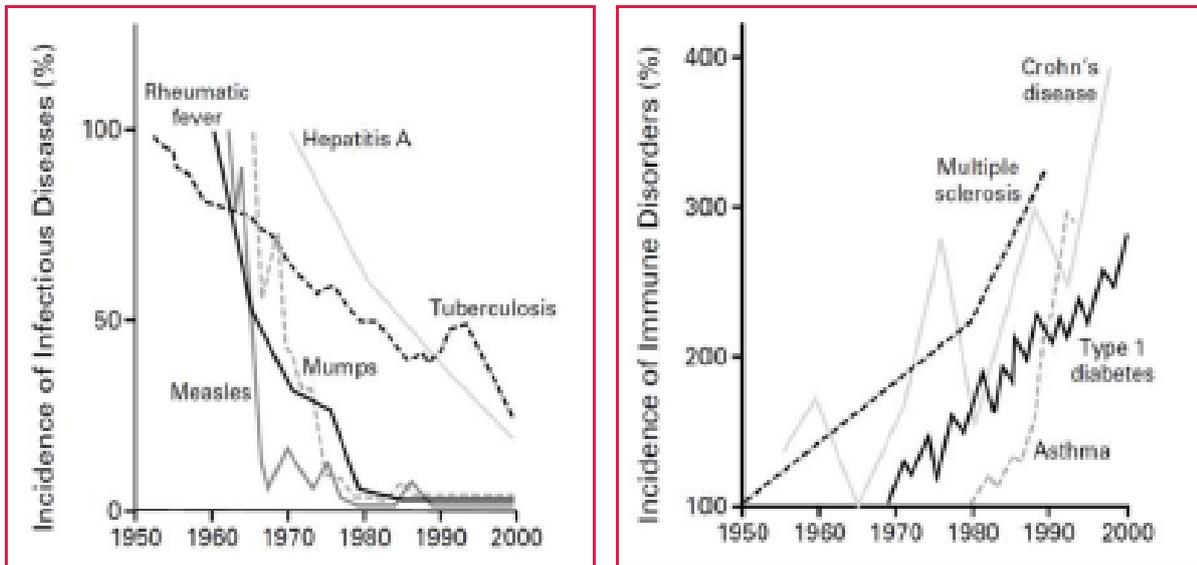
An adequate intake of all essential nutrients is required for long-term health, healthy aging and risk reduction of NCDs

不適切な微量栄養素の摂取量は、長期間の健康と身体能力に影響する

- 栄養状態 代謝反応
- 望ましい 長期間の健康、ウェルネス、活力
- 不十分 機能障害、非感染性疾病発症のより高いリスク
- 欠乏 欠乏症

長期間の健康、健康な加齢および非感染性疾病発症のリスク低減においては、全栄養素の適切な摂取が必要である。

Health and risk for diseases changed in the last century



We achieved a lot of progress in infectious diseases however face an unprecedented rise in non-communicable diseases

Source: Bach et al, NEJM 2012

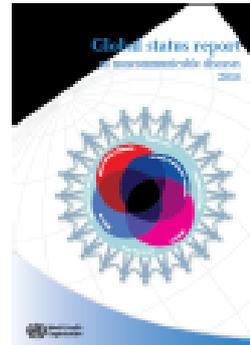
20世紀に変化した疾病のリスクと健康

- 感染症の発症率
 - リウマチ熱、A型肝炎、はしか、おたふくかぜ、肺炎
 - 免疫疾患の発症率
 - 多発性硬化症、クローン病、I型糖尿病、喘息
-
- 感染症の発症・治癒に関しては、大きな進歩があった。しかしながら、非感染性疾患発症のこれまでにない増加に直面している

More than 40% of nutrition related diseases take place before the age of 70

Approximately one third of cancers can be prevented

Up to 80% of heart disease, stroke and diabetes type 2 deaths are preventable.



<http://www.who.int/gho/ncd/en/index.html>

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- 栄養<状態>と関連する疾病の40%以上は、70歳までに発症
- 「がん」の約1/3が、予防可能と思われる
- 心臓病、発作およびⅡ型糖尿病は、80%まで、予防できる。

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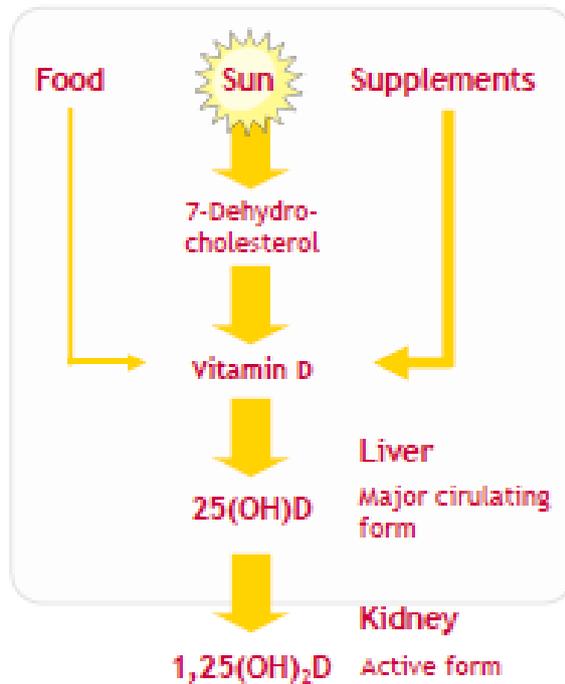
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Vitamin D comes from different sources Serum level is an indicator for individual status



25(OH)D serum level (nmol/L) is a sensitive indicator of Vitamin D status (IOM 1997)

Four ranges are suggested to assess the individual status:

(nmol/L)

< 25	25-50	50 - 75	> 75
deficient	insufficient	(in)adequate	Desirable/optimal

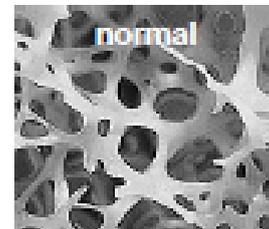
ビタミンDの供給源は複数ある 個々人のビタミンD状態の指標は、血清濃度

- 左部分のフロー:
- 食品、日光、栄養素補給、7-デヒドロコレステロール、25(OH)D; 肝臓(主要な循環型)、1,25(OH)₂D; 腎臓(活性型)
- 右部分:
- 血清25(OH)D濃度(nmol/L)が、ビタミンD状態の適切な指標(IOM 1977)。個々人のビタミンD状態の評価に下図の4段階が推奨されている。
- 欠乏、不十分、(不)適切、望ましい/至適

Vitamin D: the inadequate status impacts a number body functions

Classical role of vitamin D: bone health

- Improves bone mineral density through calcium absorption and deposition
- Necessary to prevent rickets & osteomalacia



Emerging health benefits of vitamin D

- Muscle
 - Reduces risk of falling by improving muscle strength
- Immunity
 - Strengthens the immune system
 - Reduces risk of multiple sclerosis and diabetes type
- Cardiovascular
 - Lowers blood pressure
- Cancer
 - Inhibits cell proliferation

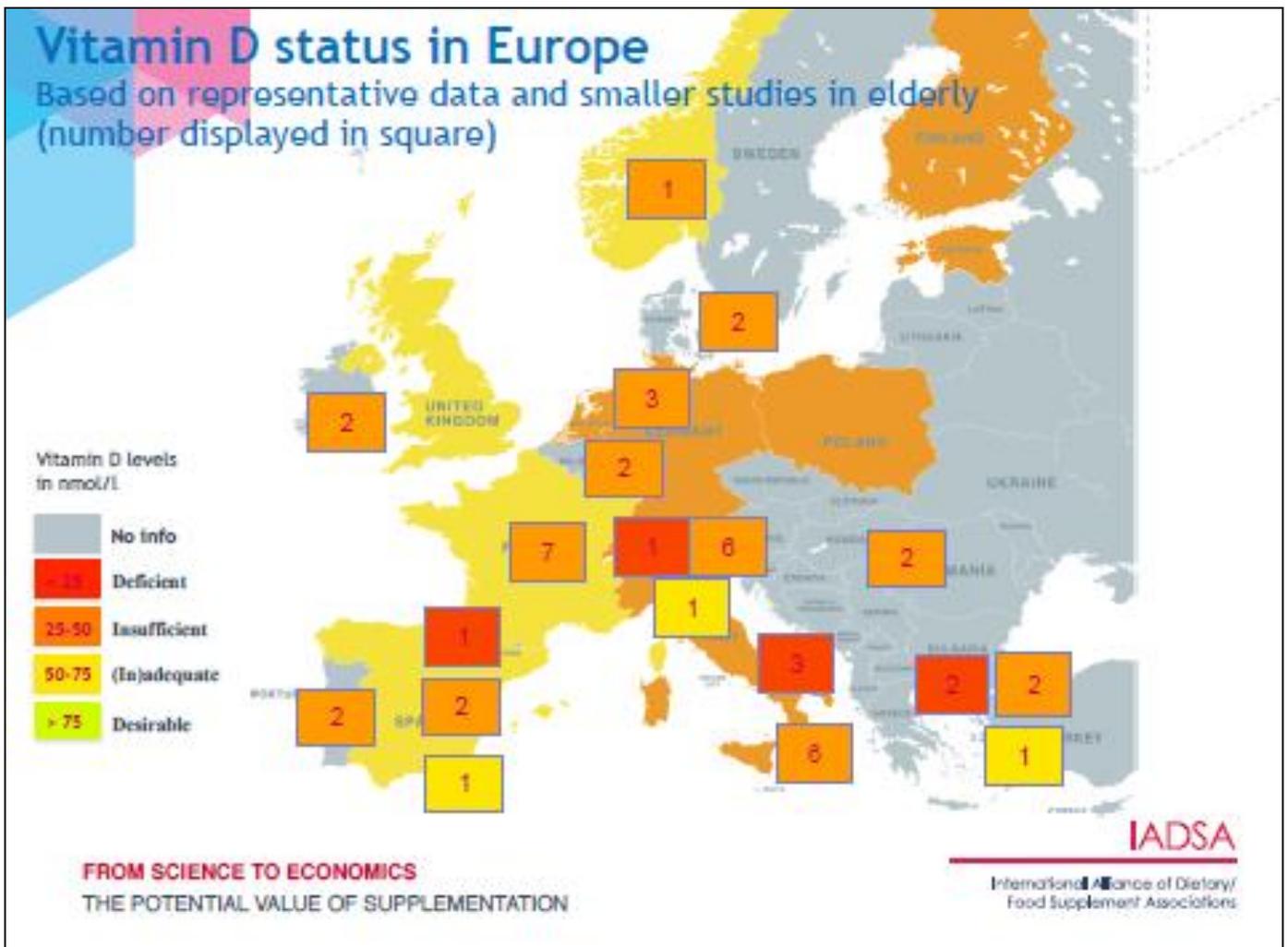


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ビタミンD: 不適切な体内状態は、多くの身体機能に影響する

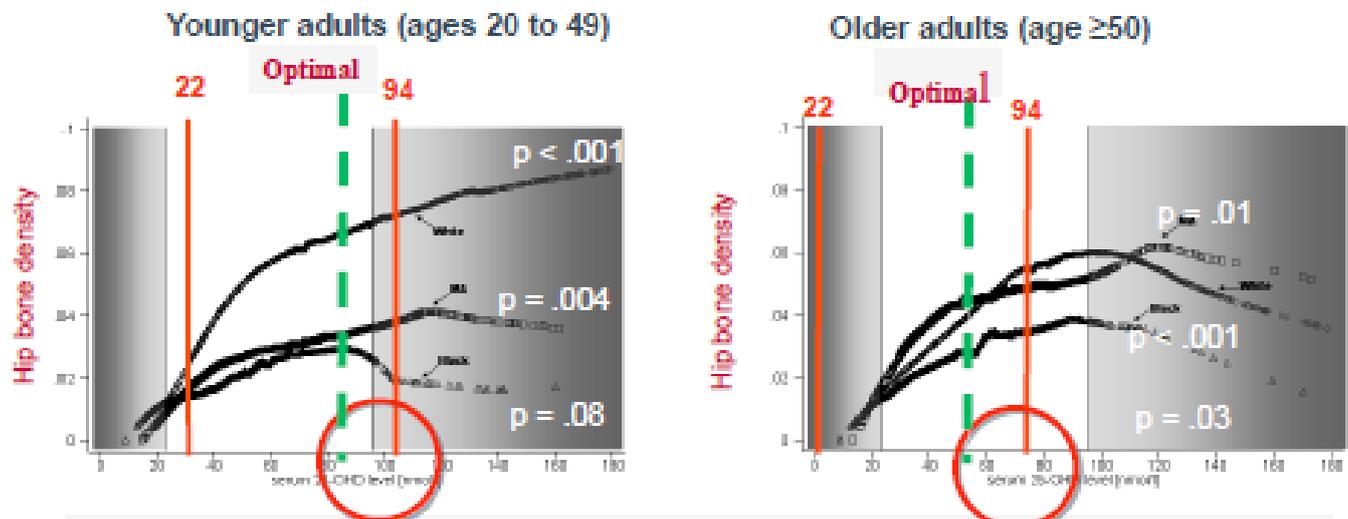
- **ビタミンDの従来からの役割: 骨の健康維持・増進**
- カルシウム吸収と蓄積<貯蔵>により、骨のミネラル密度を改善
- くる病や骨軟化症の予防に必要
- **ビタミンDの新たな健康における有益性**
- 筋肉; 筋肉の強度を改善することで転倒リスク低減
- 免疫能; 免疫系を亢進、多発性硬化症と糖尿病のリスク低減
- 心臓血管系; 血圧を下げる
- がん; 細胞増殖を阻害
- **写真; 上; 正常者、下; 骨粗鬆症患者**



ヨーロッパにおけるビタミンD状態 高齢者を対象にした代表的なデータおよび より小規模研究(口内に数字を記載)

- 血清ビタミンD濃度 (nmol/L)
- 情報がない
- 欠乏
- 不十分
- (不)適切
- 望ましい/至適

A higher hip bone density depends on the 25(OH)D plasma levels



Bone mass density (BMD) increases with higher 25(OH)D plasma level in younger and in older adults of different ethnicities

Bischoff-Ferrari HA, Stähelin HB, et al. Am J Med 2004

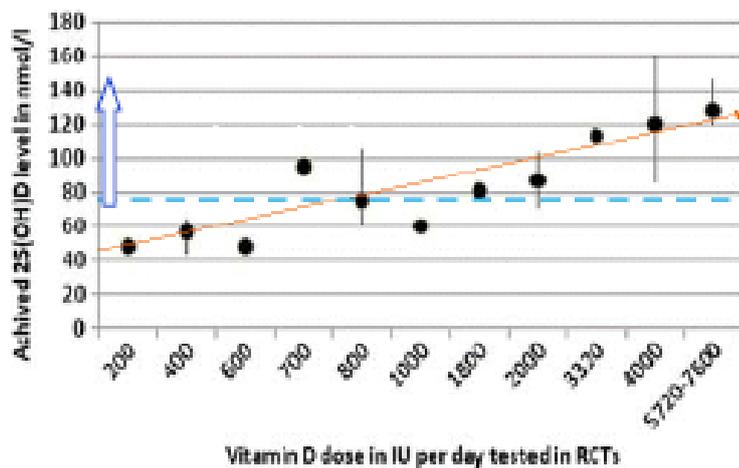
血漿25(OH)D濃度依存の高い股関節骨密度

- 左図: 青年? (20~49歳)、右図: 成人(50歳以上)
- 図下の説明
- どの民族の成人でも、より高い血漿25(OH)D濃度で、骨密度(BMD)が、増加する。

Intake of vitamin D and achieved 25(OH)D plasma level, a clear dose-relationship

RCTs analyzed

RCTs with vitamin D less than 10'000 IU per day and duration of at least 4 weeks



Conclusion

- Optimal 25(OH)D range between 75 - 110 nmol/L
- These levels can be best obtained with oral doses in the range of 700 IU - 2000 IU
- Benefit is clearly dose dependent

Bischoff-Ferrari, 2009 Osteoporos Int

ビタミンDの摂取量と血漿25(OH)D濃度は、 明確な用量相関関係がある

- 無作為対照比較介入試験 (RCTs) による結果を解析
- ビタミンD摂取量が1日1万IU以下で最短4週間のRCTs
- 結論
- 血漿25(OH)D濃度の至適範囲は、75 - 110 nmol/L
- 上記至適濃度は、700 - 2000 IUの経口摂取で達成
- 用量依存が明確という有益性

Example Germany: Cost impact of low vitamin D status on fractures

Hip and vertebral fractures have the most „cost-intense“ medical implications

Number osteoporosis patients: 8-10 mio (2010)*

Number of hip and vertebral fractures p.a.: 150.000*

Optimized vitamin-D status reduces number of fractures by 20 %

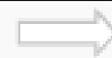
Reduction of 5.478 hip fractures and 18.420 less vertebral fractures
(in osteoporosis-diagnosed population)

Net socio-economic benefit ranges from* :

Including medical and therapeutic costs for prevention,
treatment and supplementation costs vitamin D

up to

Including societal perspective, e.g. family care,
reha costs



585 mio €



778 mio €

Source*Sproll 2011

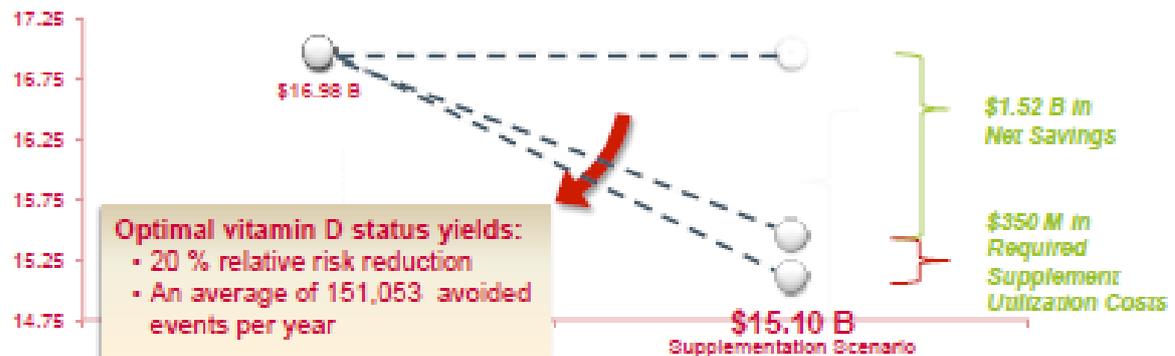
ドイツの例：骨折における低濃度ビタミンDの医療費に対する影響

- 股関節および椎体骨折は最も“高治療費”
- 骨粗鬆症患者数：800 – 1000 万人（2010年）
- 股関節および椎体骨折患者：15万人/年
- 至適ビタミンD状態は、骨折症例を20%低減する
- 股関節患者を5478人、椎体骨折患者を18420人減らす（骨粗鬆症と診断された集団対象）
- 正味の社会経済的有益性の範囲は、585（百万ユーロ）＜予防に関する医療・治療費、ビタミンDの治療、補給費を含む＞から778（百万ユーロ）＜社会的な観点、例として家族におけるケア、リハビリ費＞。

US: Potential cost savings by vitamin D supplementation

By vitamin D supplementation among all women over 55 years with osteoporosis, up to USD 1.5 billion savings per year could be realized.

Health Care Expenditures in B USD



Source: Frost & Sullivan analysis

米国：ビタミンD補給による想定される医療費節約

- **タイトル下囲み**；55歳以上の女性で骨粗鬆症患者にビタミンDを補給することで、年間に\$15億医療費が節約できることが実証された。
- **図左上**；ヘルスケア費用\$10億
- **図内の囲み**；至適ビタミンD状態は、相対リスクを20%減らす。年間平均151053人が罹患しなかった
- **図右**；\$1,52B；正味の節約、\$350M；日常的なサプリメント使用の費用、\$15.10B 補給の場合

Vitamin C deficiency is common - also in the Western world

Table 1. Prevalence of vitamin C deficiency in larger cross sectional population studies

Study	Subjects (n)	Severe vitamin C deficiency (< 11 µmol/l)	Marginal vitamin C deficiency (11 - 25 µmol/l)	Suboptimal vitamin C status (25 - 50 µmol/l)	Comment
NHANES II ^(M)	15769	14% (M) 10% (F)	20% (M) 17% (F)	NR	31% (M) and 25% (F) of the smokers alone were diagnosed with severe vitamin C deficiency
NHANES II ^(F)	11582	2%	8%	NR	7 and 20%, respectively, in smokers alone
NHANES II ^(F)	8453	NR	8% (NSM) 30% (SF)	21% (NSM) 35% (SF)	Subpopulation aged 30 years or older
CARDIA ^(M)	2637	NR	8% (NSM) 26% (SM)	33% (NSM) 40% (SM)	Numbers with marginal vitamin C deficiency include those with severe vitamin C deficiency
Third Glasgow MONICA population survey ^(M)	1287	28% (M) 14% (F)	22% (NSM) 16% (NSF) 30% (SM) 30% (SF)	NR	36% (M) and 23% (F) of the smokers alone were diagnosed with severe vitamin C deficiency
French population study ^(M)	1039	7-12% (M) 3-5% (F)	10-46% (M) 3-35% (F)	NR	Values are ranges of various age groups

NHANES II, Third National Health and Nutrition Examination Survey; M, males; F, females; NR, not reported; NHANES II, Second National Health and Nutrition Examination Survey; NS, non-smokers; S, smokers; CARDIA, Coronary Artery Risk Development in Young Adults Study; MONICA, Monitoring of Trends and Determinants in Cardiovascular Disease; NSM, non-smoking males; NSF, non-smoking females; SM, smoking males; SF, smoking females.

¹Range used: 25 to 50 µmol/l

²Range used: 20 to 45 µmol/l

³Range used: 11 to 19 µmol/l

**> 10⁸ have chronic Vitamin C deficiency
No one knows the consequences...**

Lykkesfeldt og Poulsen, Brit. J. Nutr. (2010)

ビタミンC欠乏症は、欧米世界でも共通の課題

- 慢性的なビタミンC欠乏症者は、1億人以上いる。これらの事実を誰も知らない。

Observational studies report positive health effects associated with elevated vitamin C plasma levels

Ref.	Study population	Mean vitamin C level (standard deviation)	Disease outcome	Main results
Strom et al., 2004	8,433 adults	45.9 μmol/L (normal) and 79.3 μmol/L	CHD, all-cause mortality	Subjects with normal or somewhat raised ascorbic acid levels (45.9 μmol/L and 79.3 μmol/L, respectively) had a "marginally" significant 20–23% decreased risk of fatal CHD and a significant 22% decreased risk of all-cause mortality compared to subjects with the lowest vitamin C levels (23.0 μmol/L).
Borch-Johnsen et al., 2004	879 cases and 1794 controls	77.1 μmol/L	CHD	Subjects with the highest vitamin C levels (77.1 μmol/L) had a 23% lower risk of fatal CHD compared to subjects in the lowest quartile (23.0 μmol/L).
Shaw et al., 2001	18,406 men and women	73.6 μmol/L in men and 88.1 μmol/L in women	CHD cases, all-cause mortality	Subjects in the top quartile (73.6 μmol/L in men and 88.1 μmol/L in women) had a 20% lower risk of fatal CHD and a 23% lower risk of all-cause mortality compared to subjects in the lowest quartile (23.0 μmol/L).
Strom et al., 1998	8,433 adults	65.2 μmol/L	CHD, all-cause mortality	Subjects with the highest vitamin C levels (65.2 μmol/L) had a 20% lower risk of fatal CHD and a 23% lower risk of all-cause mortality compared to subjects with the lowest vitamin C levels (23.0 μmol/L).
Pyörälä et al., 1997	1,475 men	Observational	CHD	Subjects with the highest vitamin C plasma levels (> 278 μmol/L) had a 20% lower risk of death from stroke compared to subjects with lower vitamin C levels.
Langheim et al., 2001	83 people	Observational	Stroke	Subjects with the highest vitamin C plasma levels (> 278 μmol/L) had a 20% lower risk of death from stroke compared to subjects with lower vitamin C levels.
Gale et al., 2001	1,475 men	Observational	Stroke	Subjects in the top quartile of baseline plasma vitamin C (73.6 μmol/L) had a 42% lower risk of stroke than those in the bottom quartile (23.0 μmol/L), independent of age, sex, BMI, systolic blood pressure, smoking, alcohol consumption, cholesterol, total cholesterol, physical activity, diabetes, myocardial infarction, or aspirin use.
Shaw et al., 2001	18,406 men and women	Observational	Stroke	Subjects with the highest vitamin C plasma levels (> 278 μmol/L) had a 20% lower risk of death from stroke compared to subjects with lower vitamin C levels.

Cohorts with elevated vitamin C levels have lower CHD risk by 20 - 42 %

Source: B. Frei et al.

観察研究によりポジティブな健康効果が報告される

ビタミンC血漿レベルの増加と相関する。すなわち、心臓疾患のリスクを、20~42%低減する（表箇所）。

Vitamin C - reduces *duration* of colds

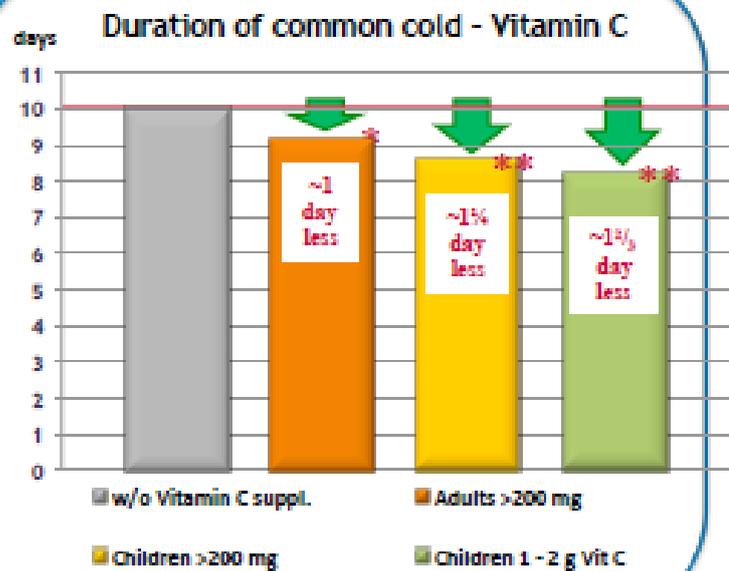
Taking regularly
≥ 200 mg/d Vitamin C

Regular supplementation with
Vitamin C reduces the
duration of colds in adults*
and in children**

*(17 trials, 8%; p=0.0002)

** (14 trials, 14% / 18%;
p<0.0001)

No drug has a similar
benefit like vitamin C
➡ communicate!



Meta-analysis*

*Hemilä H., Chalker E.: Cochrane Database
Syst Rev. 2013

ビタミンCは、風邪の罹患期間を短縮

- 日常的に、ビタミンCを1日200mg摂る
- ビタミンCの日常的な補給は、小児と成人における風邪の罹患期間を短縮
- 上記機能において、ビタミンCと同様の有益性を示す医薬品はない→普及させるべき！
- 図上部；風邪の罹患期間 – ビタミンC
- 図下部；メタ解析<分析>

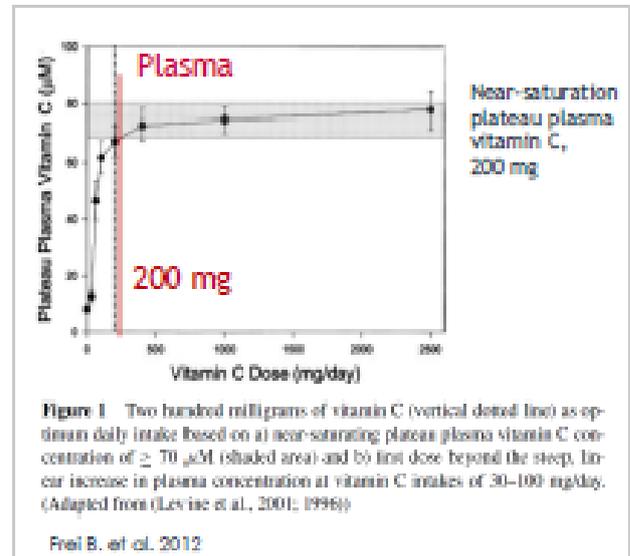
Vitamin C - optimal intake is 200mg per day

Based on the evidence from human metabolic, pharmacokinetic, and observational studies and RCTs, we conclude:

200 mg per day is the optimum dietary intake of vitamin C

to maximize the potential health benefits with the least risk of inadequacy or adverse health effects.

Source: http://www.cdc.gov/nutritionreport/pdf/Nutrition_Book_complete508_final.pdf



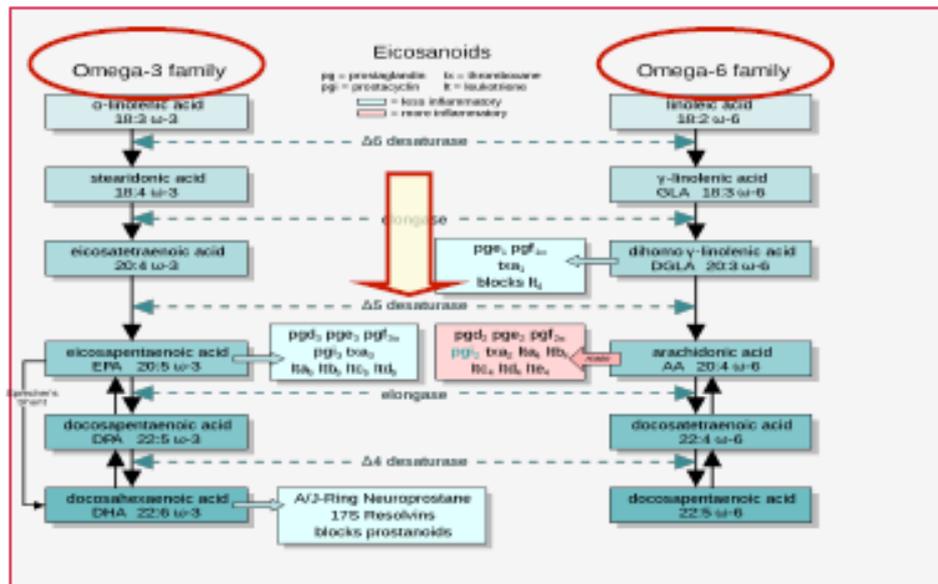
ビタミンC – 至適摂取量：1日200mg

- ヒトの代謝、薬物動態、観察研究およびRCTの根拠に基づく講演者の結論
- ビタミンC – 至適摂取量：1日200mg
- 不適切な状態あるいは有害事象ノリスクを最小化すると共に想定可能な健康における有益性を最大化するために
- 右図の右部分：200mg摂取で、血漿ビタミンC濃度は飽和状態。

Omega-3 Fatty Acids and Heart Health

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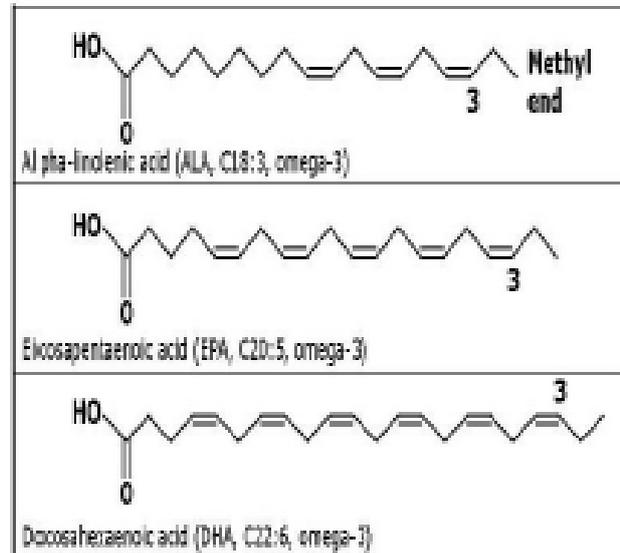
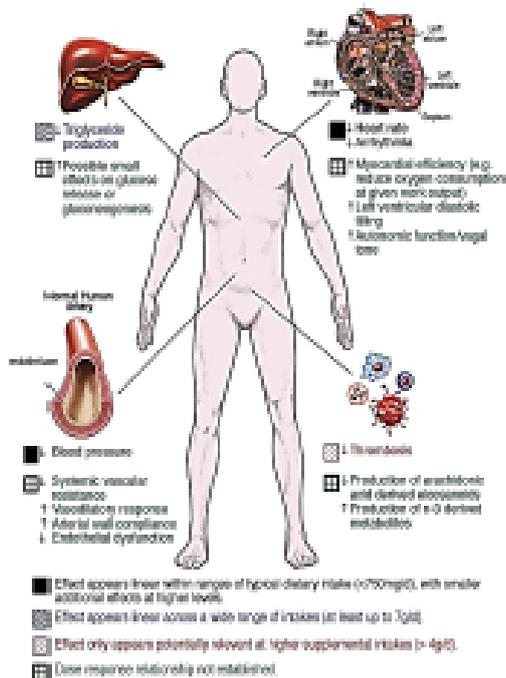
オメガ-3脂肪酸と心臓の健康

- オメガ-3脂肪酸 エイコサノイド オメガ-6脂肪酸

Omega-3s Affect Several Functions/ Structures

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Taken from Mozaffarian et al. 2011 J Am Coll Cardiol 58:2047

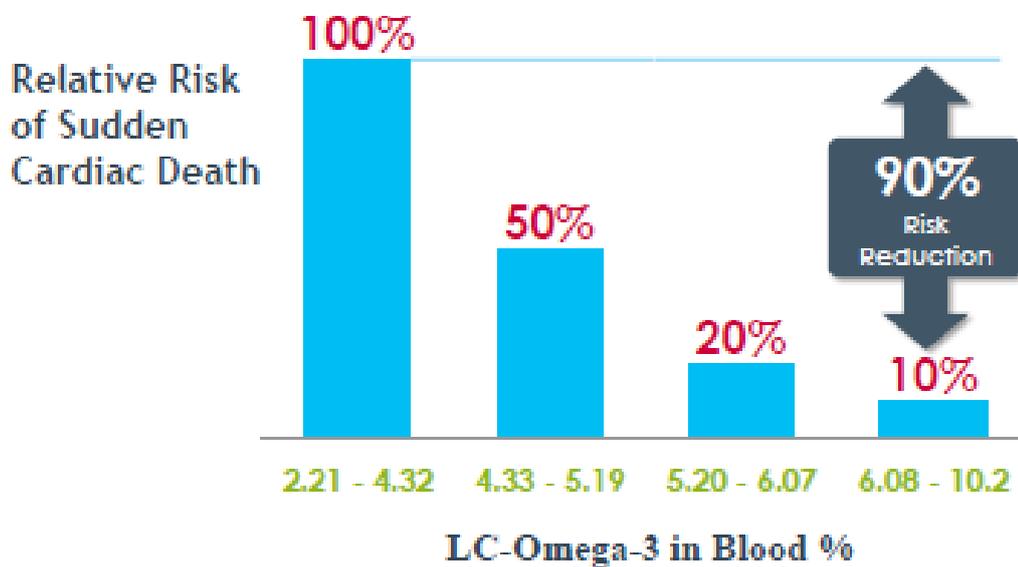
オメガ-3脂肪酸は、多様な機能と組織構造に影響

- 右図
- アルファリノレン酸 (ALA、C18:3、オメガ-3)
- (エ) イコサペンタエン酸 (EPA、C20:5、オメガ-3)
- ドコサヘキサエン酸 (DHA、C22:6、オメガ-3)

Omega-3 Intake and Risk of Sudden Death Physicians' Health Study

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Source: 2002 NEJM 346:1113-1118

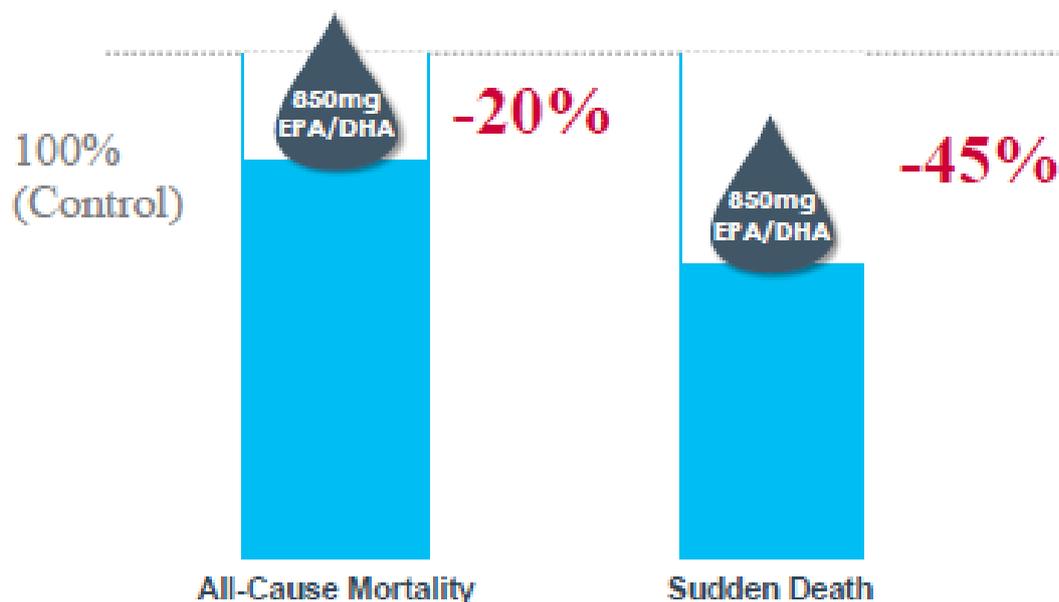
オメガ-3脂肪酸摂取と突然死のリスク Physician's Health Study

- 縦軸; 突然の心臓死の相対リスク
- 横軸; 血中長鎖不飽和脂肪酸オメガ-3 (%)

Fish Oil Supplements Reduce Mortality GISSI-Prevenzione RCT

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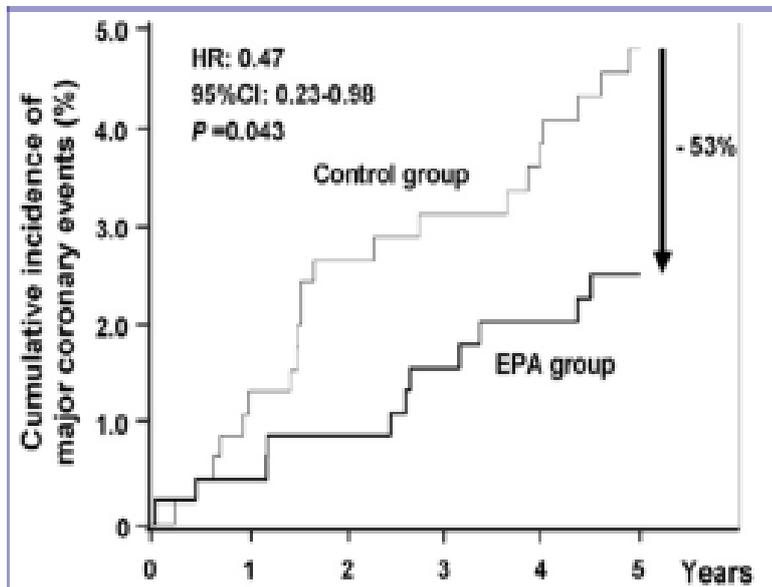


Source: *Lancet* 1990; 354:447-455

魚油補給は死亡率を減らす GISSI-Prevenzione RCT

- 全死亡原因による死亡率
- 突然死

EPA and Major Coronary Events Japan EPA Lipid Intervention Study (JELIS)



- Hypercholesterolemic patients
- High omega-3 intakes in Japan
- Benefits seen even with statin use

Source: Saito et al. 2008 Atheroscler 200:135

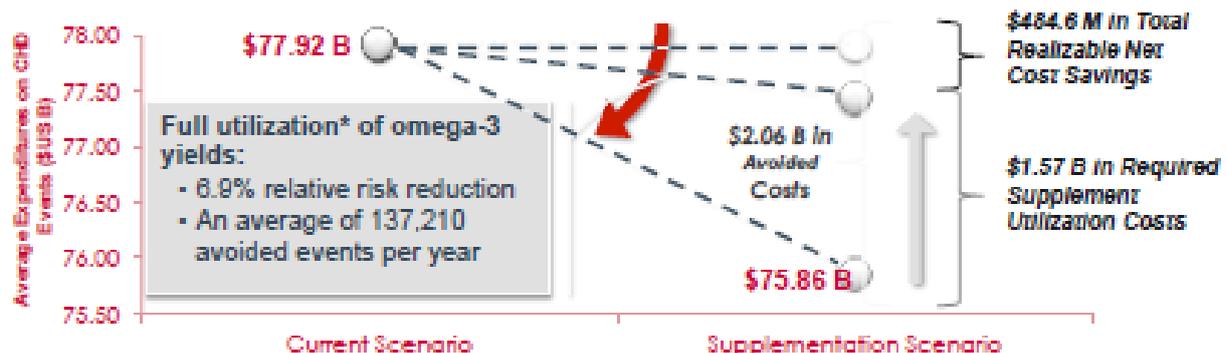
EPAと主要な冠血管系症状 JELIS

- 縦軸: 主要な冠血管系症状の累積発症率 (%)
- 対照群、EPA摂取群
- 右囲み内;
- 過コレステロール血症患者
- 日本における高オメガ-3摂取者
- スタチン服用でみられた有益性

Benefits of Omega-3—Potential CHD Cost Savings

The potential net savings in avoided CHD events derived from the use of omega-3 supplements would be an annual average of \$484.6 M per year

Net Annual Average Cost Savings due to Avoided Health Care Expenditures through Omega-3 Intervention, 2013–2020



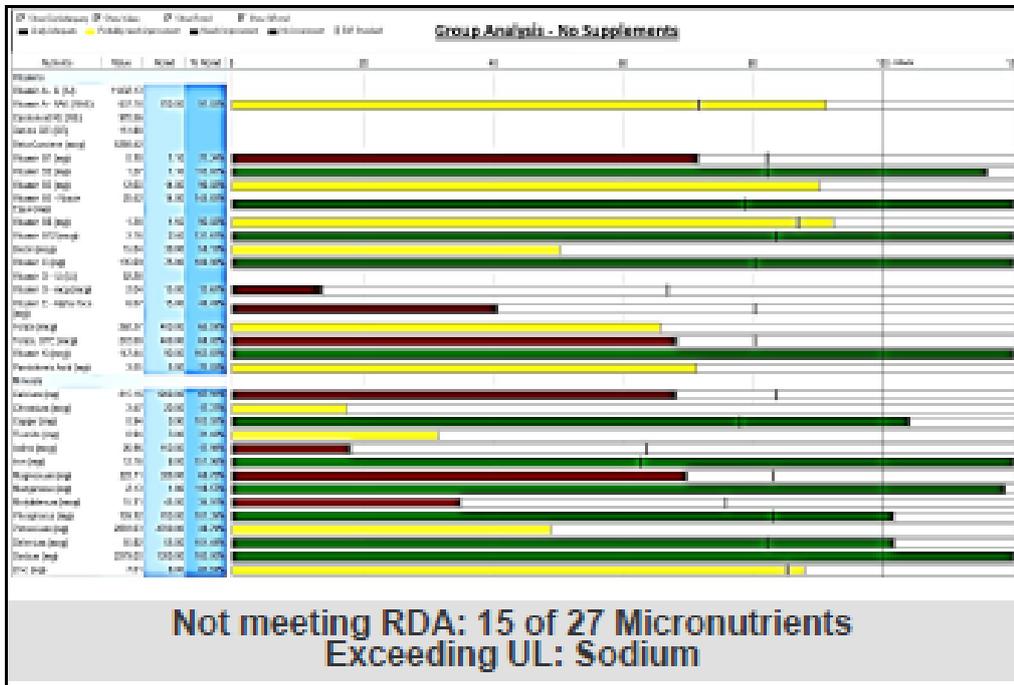
Source: Frost & Sullivan analysis. Note: * Among all adults over the age of 55 with CHD

オメガ-3脂肪酸の有益性—想定される心臓血管系疾病医療費節約効果

- オメガ-3脂肪酸摂取によって心臓血管系疾病発症が回避できた場合の想定される正味の医療費節約効果は、年平均\$484.6mio.になる。
- オメガ-3脂肪酸摂取によって心臓血管系疾病発症が回避できた場合の想定される正味の医療費節約(2013-2020年)。
- オメガ-3のフル摂取によって、相対リスク比が、6.9%低下、年平均137,210人が発症を回避<55歳以上の心臓血管系疾病がある成人>

How to close micronutrient gaps?

3-day food diaries; "Food Processor" (USDA National Nutrient Database)



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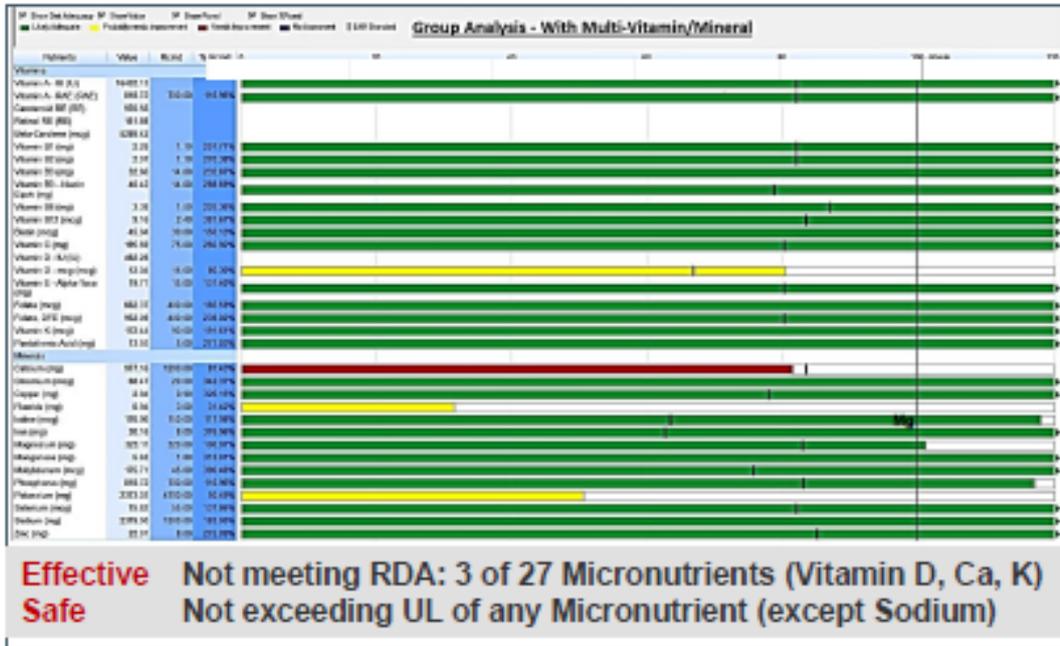
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微量栄養素のギャップをなくすための手法

- 3日間の食事記録による調査“Food Processor”（米国農務省、国民栄養データベース）
- RDAに達していない栄養素：27栄養素中15
- ULを超えている栄養素：ナトリウム

Supplements close most dietary micronutrient gaps

3-day food diaries; "Food Processor" (USDA National Nutrient Database)



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食事からの微量栄養素のギャップをなくすための最適な手段としてのサプリメント

- 有効: RDAに達しなかった栄養素: 27栄養素中3(ビタミンD, カルシウム, カリウム)
- 安全: ナトリウムを除いてULを超えた栄養素は無し。

Micronutrient challenges and opportunities: Where do we stand?

- Inadequate micronutrient intake is a global issue
- Opportunities: Case studies
 - Vitamin D
 - Vitamin C
 - Omega-3
- Challenges in micronutrients
- Summary and outlook

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微量栄養素による挑戦と機会：現状は？

- 微量栄養素の摂取量が不適切であることは、世界的な課題
- 機会：事例研究
- ビタミンD
- ビタミンC
- オメガ-3
- 微量栄養素における挑戦
- 要約と今後の展望

Challenges in micronutrients

- Media reports are often negative and challenging concerning the role of vitamins for health and well-being
- We need updated recommendations for nutrients (WHO, CODEX,...)
- We lack European harmonization
- We need more funding for nutrition science and the role of micronutrients
- Dietary risk are the key factor for mortality; we miss data

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微量栄養素による挑戦

- 健康とwell-beingに関するビタミンの役割に関して、否定的なメディア報告が、頻繁に発信されるが、挑戦していく価値がある。
- 栄養素に関する再考された更新推奨量が必要（WHO、CODEX等）
- ヨーロッパにおける調和ができていない
- 栄養科学と微量栄養素の役割に関して、もっと投資が必要である。
- 食事によるリスクが死亡率の重要因子であることのデータを、見逃している

We need updated recommendations for nutrients

Micronutrient recommendations during pregnancy

Currently, the WHO recommends pregnant women to take Iron and Folic Acid supplements only!

However, many micronutrients, including iron and folic acid are essential during pregnancy.....

DR	Females	Pregnancy	Change during Pregnancy
Vitamin A (µg RE)	700	770	Declines in malnourished pop.
Vitamin D (IU)	600	600	Increases in late gestation
Vitamin E (mg)	15	15	Increases
Vitamin K (µg)	90	90	Little data
Folate (µg DFE)	400	600	Declines due to hemodilution
Thiamine (mg)	1.1	1.4	No change
Riboflavin (mg)	1.1	1.4	No change
Niacin (mg)	14	18	No change
Vitamin B-12 (µg)	2.4	2.6	Declines due to hemodilution
Vitamin B-6 (mg)	1.3	1.9	Declines due to hemodilution & hormonal factors
Vitamin C (mg)	75	85	Declines due to hemodilution
Iodine (µg)	150	220	UI decreases
Iron (mg)	18	27	Declines due to hemodilution and deficiency
Zinc (mg)	8	11	Declines due to hemodilution and deficiency
Calcium	1000	1000	Declines until 34 week

The benefit of multi-micronutrient complex is demonstrated

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栄養素に関する再考された更新推奨量が必要

- **左部**: 微量栄養素: 妊婦における推奨
- 現在、WHOは、妊婦に対して鉄と葉酸をだけを補給することを推奨している。
- しかしながら、鉄、葉酸を含む微量栄養素は、妊婦には必須である。
- **下部**: 多種類の微量栄養素複合製品の有益性が示されている

We miss aligned recommendations in Europe (Example vitamin E)

Table 2 Comparison of recommended daily intakes (RDAs/PRIs) of vitamins and minerals for adults derived from different countries and organisations

Vitamins	B ₁ Thiamine (mg)	B ₂ Riboflavin (mg)	Niacin (mg)	B ₆ (mg)	Folate (µg)	B ₁₂ (µg)	C (mg)	A (µg RAE ¹)	D (µg)	E (mg)	K (µg)	Pantothenic acid (mg)	Biotin (µg)
European Union (including Greece), 1992 ²	1.0-0.9	1.6-1.3	16-14	1.3-1.1	200	1.4	45	700-500	0-10	6.4 ³ (24-20)	-	3-12	15-100
Belgium, 2000 ²	1.0-0.9	1.6-1.3	16-14	1.3-1.2	200	1.4	70	700-500	2.5-10	10	-	3-12	15-100
France, 2000 ²	1.3-1.1	1.6-1.3	14-13	1.4-1.3	330-300	2.4	110	600-500	5	12	45	3	50
Germany, Austria, Switzerland, 2000 ²	1.2-1.0	1.4-1.2	16-15	1.3-1.2	400	2.0	100	1000-800	5	10-11	70-60	6	30-20
Ireland, 1990 ²	1.0-0.9	1.6-1.3	16-14	1.3-1.1	300	1.4	60	700-500	0-10	-	-	-	-
Italy, 1996 ²	1.0-0.9	1.6-1.3	16-14	1.3-1.1	200	2	60	700-500	0-10	10	-	-	-
Netherlands, 1989, 2000, 2000 ² , ³	1.1	1.3-1.1	17-15	1.3	300	2.0	70	1000-800	2.5-3	11.0 9.3	-	3	-
Nordic countries, 1996 ²	1.4-1.1	1.6-1.3	16-15	1.3-1.2	300	2.0	60	600-500	3	10.0	-	-	-
Portugal, 1982 ²	1.3-1.2	1.6-1.4	16-14	1.2	400	1.0	70	1000	-	-	-	-	-
Spain, 1994-1996 ²	1.0-0.9	1.6-1.4	16-15	1.4-1.4	200	2.0	60	700	2.5	12	-	-	-
United Kingdom, 1991 ²	1.0-0.8	1.3-1.1	17-15	1.4-1.2	200	1.3	40	700-500	-	10-5	70-60	3-7	10-20
United States, 1997, 1998, 2000, 2000 ² , ³ , ⁴ , ⁵	1.3-1.1	1.3-1.1	16-14	1.5	400	2.4	90-75	900-700	5	15	120/ 90	3	30
IAD/WBC, 2002 ²	1.3-1.1	1.3-1.1	16-14	1.5	400	2.4	40	600-500	5	10-7.5	60-35	3	30
Reference Labeling Value (RLV) ⁶	1.1	1.4	16	1.4	400	2.5	60	600	5	12	75	6	50

When there are 2 values, the left-hand side value represents the contribution advised for men, that of right-hand side for women. When a range of values is proposed, it is indicated by sign “-”.

¹ Retinol equivalents. ² mg/µg RDA.

ヨーロッパにおける横並びの推奨が欠けている(例: ビタミンE)

• 表2

異なる国、機関によって設定された成人における、ビタミン・ミネラルの推奨量(RDAs/PRIs)の比較

We need more funding for nutrition science and the role of micronutrients

Nutrition and its role for prevention has a low priority on the agenda of funding bodies (EU, national level)

Very few universities engage in micronutrient research

However, there is a renaissance in micronutrients

- Understanding nutrient-gene interactions
- Progress in analytics
- Personalized nutrition

A demand for new scientific approaches



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栄養科学と微量栄養素の役割に関する活動に、もっと投資が必要である。

- 栄養と疾病予防に関する役割は、投資組織において、優先度が低い課題 (EU、各国)
- 微量栄養素の研究に関与する大学は限定されている

しかしながら、微量栄養素における改革がある
栄養素と遺伝子の相互作用を理解する
分析手法の進歩

個別化栄養

新しい科学的な取り組みに関する要求

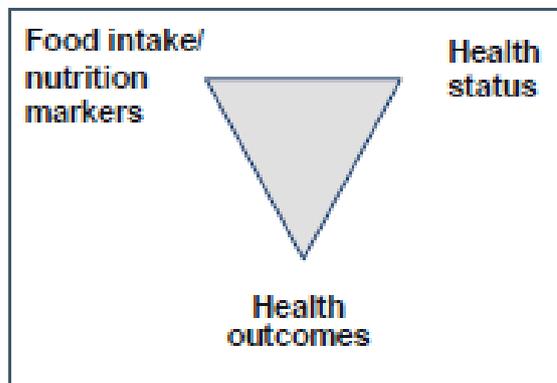
Dietary risks are the key factor for mortality

.. a need for generating data on vitamin status and health outcomes to understand underlying cause and action



Cohort with >160000 people

- Grandparents
- Parents
- Children



Assessment of vitamin status in low versus high socio-economic groups of the North-Netherlands LifeLines population and explore the phenotype of marginal/subclinical micro-nutrient deficiency

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食事によるリスクが死亡率の重要因子である

- 疾病の病因と機序を理解するためにビタミンと健康影響に関する創造されたデータが必要である。
- **左下**: 16000人以上のコホート研究
- 祖父母、父母、小児
- **右▽部分**: 食品の摂取/栄養状態マーカー、健康状態、健康への影響
- 右下: 高社会経済的集団である北オランダのLife Lines 集団に対する低社会経済的集団のビタミン状態の評価と潜在的/治療必要状態/欠乏症の遺伝子表現型の調査研究

Micronutrient challenges and opportunities: Where do we stand?

- Inadequate micronutrient intake is a global issue
- Opportunities: Case studies
 - Vitamin D
 - Vitamin C
 - Omega-3
- Challenges in micronutrients
- **Summary and outlook**

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微量栄養素による挑戦と機会：現状は？

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Summary

- Inadequate intake and status of essential nutrients is common in many countries, also in the Western world
- Adequate status is a relevant factor to improve public health
- Supplements are an effective and safe way to close the nutrient gap
- A continuous effort is required to manage challenges and generate awareness from the regulatory, media and the scientific environment.

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要約

- 必須栄養素の摂取が不適切であることは、多くの国、また欧米諸国でも共通の課題である。
- 適切な状態は、公衆衛生の改善に関する関連因子である
- サプリメントは、栄養素ギャップを埋めるのに有効で安全な手法である。
- 規制、メディアそして科学的な場から発信される知識に挑戦、そして知見を創造する対応が求められる

Support for 200 mg Vitamin C intake

Per 2012 CDC 2nd Nutrition Report, 200 mg C daily intake for the majority of the adult population is needed to maximize the vitamin's potential health benefits with the least risk of inadequacy or adverse health effects.

Source: http://www.cdc.gov/nutritionreport/pdf/Nutrition_Book_complete508_final.pdf

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Authors' Perspective: What is the Optimum Intake of Vitamin C in Humans?

RAUL FREIL,¹ ENIS BILLOUES-ARAGON,² and JENS LYKKESELEDT³

¹Lean Protein Institute, Oregon State University, Corvallis, OR, USA

²Specialty Nutrition, Paris, France

³Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark

The recommended dietary allowance (RDA) of vitamin C has traditionally been based on the prevention of the vitamin C deficiency disease, scurvy. While higher intakes of vitamin C may confer additional health benefits, the limited Phase II randomized, placebo-controlled trials (RCTs) of vitamin C supplementation have not found consistent benefits with respect to chronic disease prevention. To date, this has precluded upward adjustments of the current RDA. However, since the Phase II RCTs—designed principally to test the safety and efficacy of pharmacologic doses—did not address the health benefits of moderate intakes, and the currently available evidence is sufficient to determine the optimum intake of vitamin C in humans. This evidence consists of the biological, pharmacologic, and mechanisms of action for vitamin C in the primary prevention of coronary heart disease, stroke, and cancer; and is buttressed by consistent data from prospective cohort studies based on observational or dietary intake and well-designed Phase II RCTs. These RCTs show that vitamin C supplementation lowers hypertension, endothelial dysfunction, chronic inflammation, and the fibrinolytic profile, independent of risk factors of cardiovascular diseases and certain cancers. Furthermore, vitamin C acts as a biological antioxidant that can lower elevated levels of oxidative stress, which also may contribute to chronic disease generation. Based on the combined evidence from human metabolic, pharmacokinetic, and observational studies and Phase II RCTs, we conclude that 200 mg per day is the optimum dietary intake of vitamin C for the majority of the adult population to maximize the vitamin's potential health benefits with the least risk of inadequacy or adverse health effects.

200mgのビタミンC摂取を支持

- 2012年に発行された疾病対策予防センターの栄養報告第2報で、1日200mgの摂取が、大部分の成人において、摂取量の不適切性あるいは健康有害事象の最小のリスクでビタミンの健康に対する有益性を最大化するために必要である、と記載されている。

Omega-3 and Heart Health Summary

- Structure-function relationship established
 - Omega-3 fatty acids required for cell membranes and signaling molecules
 - Desaturation and elongation of ALA to EPA and DHA is limited
 - Increased omega-3 fatty acid status helps maintain health

- Claims sanctioned in many countries

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オメガ-3脂肪酸と心臓の健康: 要約

- 構造/機能相関関係が確立された
- オメガ-3脂肪酸は、細胞膜や分子伝達に必要である
- ALAの不飽和化と伸長化によって体内で生合成される、EPAとDHAの量は、限定的である
- オメガ-3脂肪酸の摂取量を増やして、体内のオメガ-3脂肪酸量をあげることが、健康維持に役立つ
- 多くの国で、認められた健康強調調表示