Sunlight vitamin: Dependence on supplementation – Is it the right choice ?

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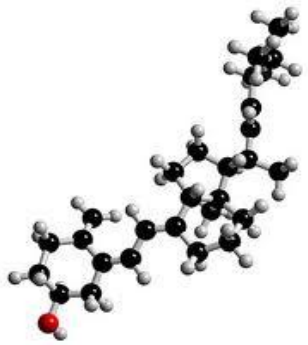
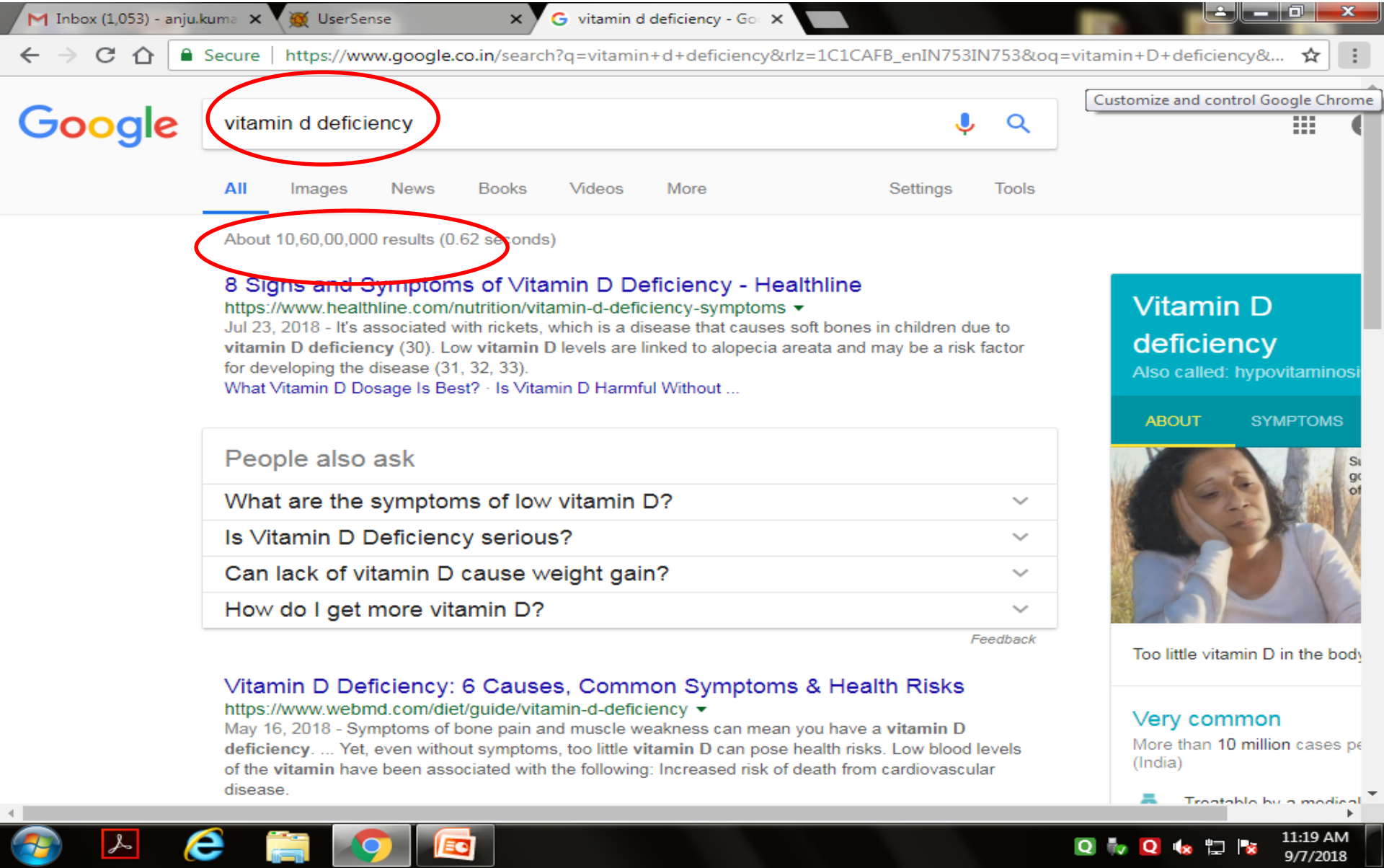
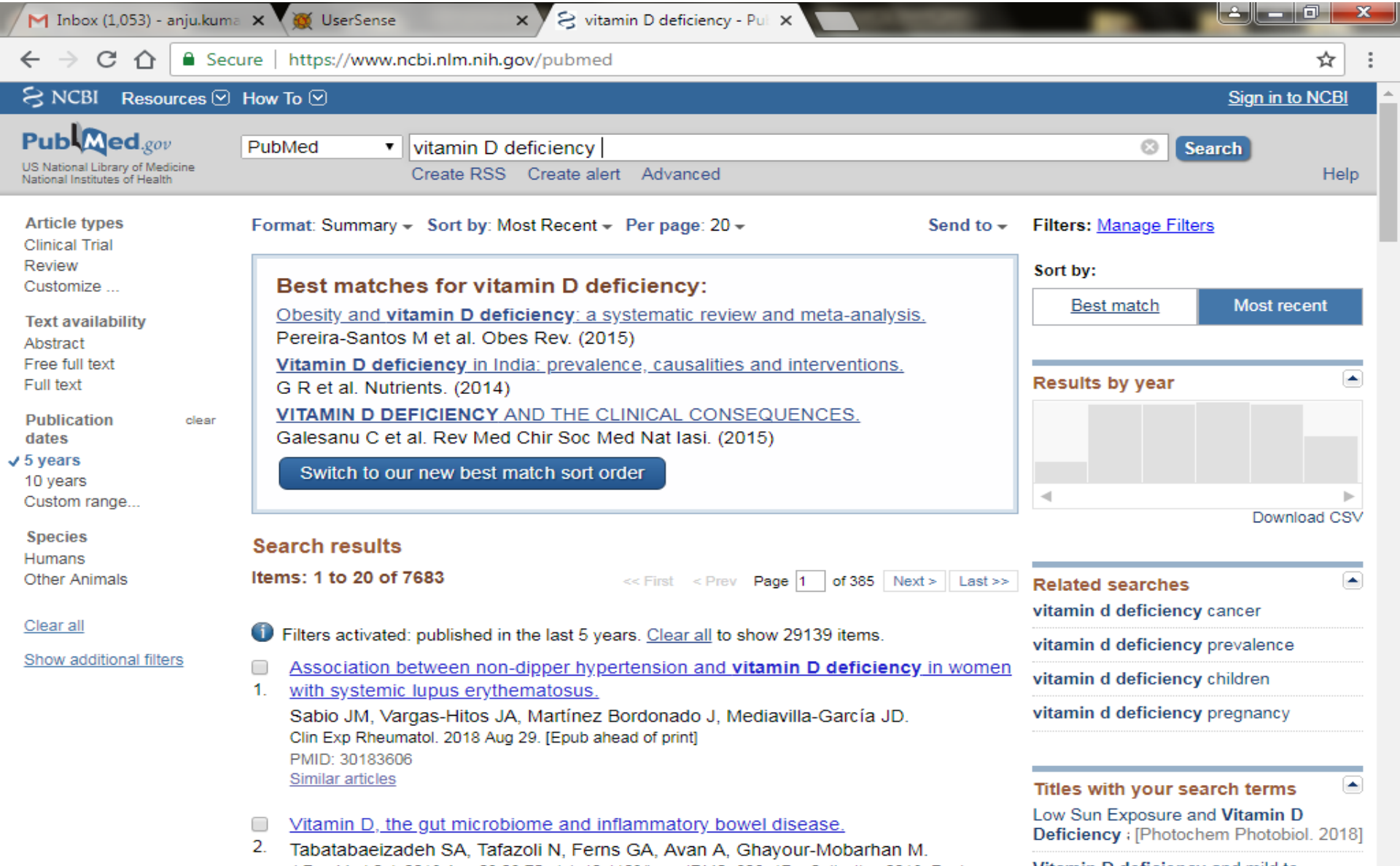


www.google.com



www.pubmed.gov

8000 Articles in last 5 years



Why sudden interest in Vitamin D?

History of Vitamin D

- Existed over 500 million years
- Cod liver oil: common folklore medicine
- Discovery of Vit D as the antirachitic factor in cod liver oil(1920)
- Discovery of conversion of 7-dehydrocholesterol in the skin to vit D (1937)
- Antirachitic property in food
- Fortification of food with vitamin D was patented
- Complete eradication of rickets in US
- US issuing warnings about sun-induced health risk
- Over next 30 yrs skin cancer hazard of excessive sun exposure became well established
- Rickets resurfaced

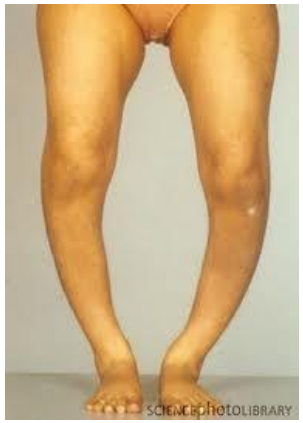
Natural Sources

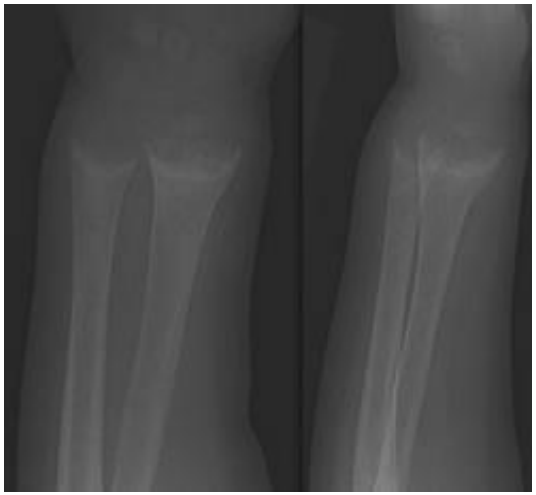
Who are at Risk for Early Vitamin D Deficiency?

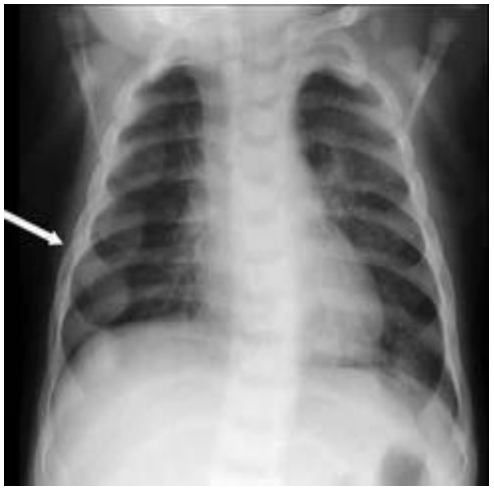
- Infants with low intrauterine accretion
  - Born to vitamin D deficient mothers
  - IUGR infants
  - Premature infants
- Infants with low vitamin D status
  - Lack of sun exposure +
  - Low dietary sources

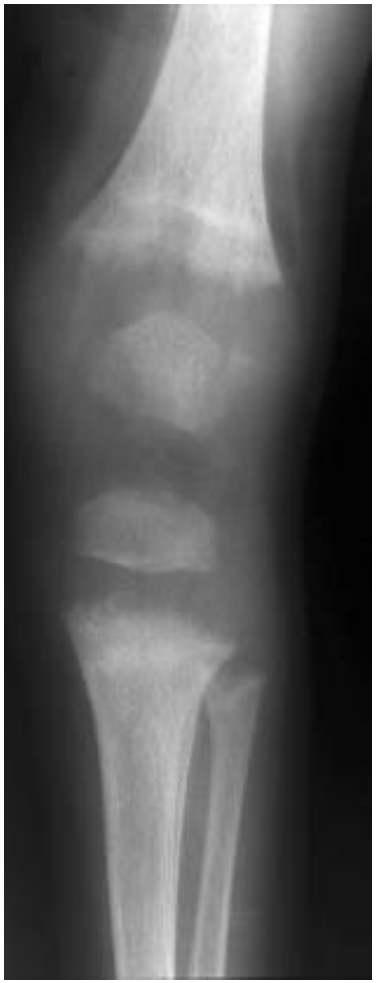
Factors Influencing Vitamin D deficiency

Vitamin D deficiency = Rickets









Biochemical vitamin D deficiency

Stage 1

- Raised SAP

Stage II

- Increase in SAP
- Decrease in Phosphorus

- **Stage III:**
- Serum calcium and Phosphorus levels very low
- SAP very high

Vitamin D
Bloodspot Testing

Global prevalence

- US – 69.5%[1]
- Europe – 86.4%[1]
- Asia – 85%[2]
- Highest rates as well as more severe deficiency in Middle East & South Asia[3]

1. Chowdhury R, Kunutsor S, Vitezova A, Oliver WC, Chowdhury S, Kiefte-de-Jong JC et al. Vitamin D and risk of cause specific death: systematic review and meta-analysis of observational cohort and randomised intervention studies BMJ 2014; 348:g1903
2. Lim S, Kim MJ, Choi SH, Shin CS, Park KS, Jang HC, Billings LK, Meigs JB. Association of vitamin D deficiency with incidence of type 2 diabetes in high-risk Asian subjects. Am J Clin Nutr 2013;97:524–30.
3. Mithal A, Wahl DA, Bonjour JP, Burckhardt P, Dawson-Hughes B, Eisman JA, et al.; IOF Committee of Scientific Advisors (CSA) Nutrition Working Group. Global vitamin D status and determinants of hypovitaminosis D. Osteoporos Int 2009; 20:1807-20

Myth and Reality

Presumed misconception

- Vast tropical country with ample sunshine throughout the year so vitamin D deficiency is unlikely

Proved reality

- Vitamin D deficiency is very common in India (50-90%) in all the age groups and both sexes

- Harinarayan CV and Joshi SR. Vitamin D status in India-Its implications and remedial measures. J Assoc Physicians India. 2009 ;57;40-48.

Maternal Vitamin D Status

1. JAPI, 2011 (Tirupati, N=191)

   76% deficient, 16% insufficient
2. Br J Nutr, 2011 (Delhi, N= 541)

   96.3% - hypovitaminosis D
3. Am J Clin Nutr, 2011 (Mysore, N = 568)

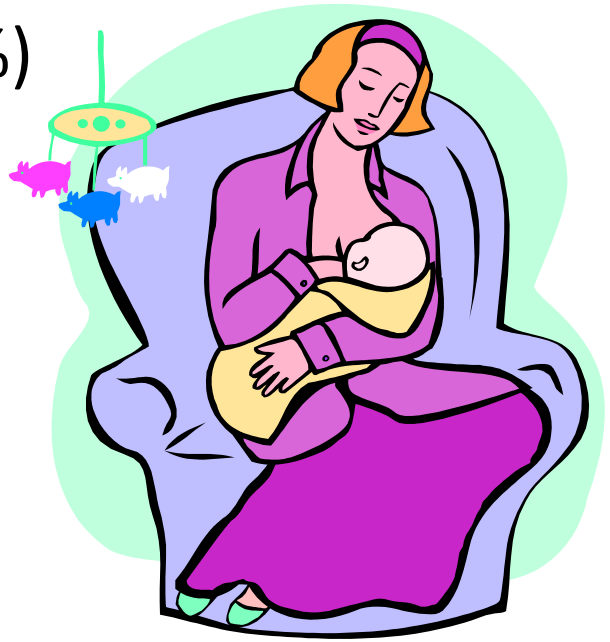
   67% - hypovitaminosis D
4. Am J Clin Nutr, 2005 (Lucknow, N = 207)

   84% deficiency

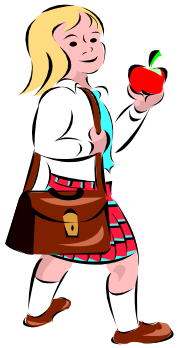
Breastfed Infants

1. IJMR 2011 (Delhi, n = 98, 3 mo)
   Infants 66.7% Mothers 81%

2. J Ped Endo (Delhi, n = 180, 2-24 wk)
   Infants 43%, Mothers 47%)



Healthy Schoolchildren



Am J Clin Nutr. 2005
(n= 5137, Delhi)
(<9):
42% (LSES); 27% (USES)

Healthy Adults

1. JAPI 2011
   (Delhi, N= 1346, > 50y)
   91% deficient, 7% insufficient
2. Postgrad Med J 2011
   (Mumbai, N= 1137, 25-35y)
   70% deficient

Is there a Rural Urban Divide?

Vitamin D deficiency in rural girls and pregnant women despite abundant sunshine (Lucknow, UP)

Clin Endocrinol. 2009

n= 121 (89%) n= 139 (74%) deficiency

Treating Rickets

	Cesur Y et al (3)	Soliman AT et al (2)	Ozkan B et al (4)	Billoo AG et al (89)	Gultekin A et al (88)
Dose of Vitamin D	150,000 IU versus 300,000 IU versus 600,000 IU	10,000 IU/Kg	300,000 IU oral versus. 300,000 IU intramuscular versus. 600,000 IU oral	200,000 IU oral versus 200,000 IU intramuscular	150,000 IU intramuscular versus 150,000 IU oral
Route	Oral	Intramuscular	Oral vs. intramuscular	Oral vs. intramuscular	Oral vs. intramuscular
Duration	30 days	90 days	7 days	90 days	30 days
Other medication	Oral calcium lactate for 7 days	–	–	–	–
Outcome	All equal in efficacy	Safe and effective	All equal in efficacy, hypercalcemia in 600,000 IU group	Both equally effective	All equally effective

Comparison of 300,000 iu versus 600,000 iu of vitamin D for treatment of nutritional rickets: open label randomized controlled study

(2010)

Scientific literature to provide evidence for the best therapy at minimum effective dose which is feasible, cost effective and free of potential adverse effects is sparse

RESEARCH PAPER

300,000 IU or 600,000 IU of Oral Vitamin D3 for Treatment of Nutritional Rickets: *A Randomized Controlled Trial*

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Received: October 25, 2013; Initial review: December 09, 2013; Accepted: February 05, 2014.

Objective: To evaluate the non-inferiority of a lower therapeutic dose (300,000 IU) in comparison to standard dose (600,000) IU of Vitamin D for increasing serum 25(OH) D levels and achieving radiological recovery in nutritional rickets.

Design: Randomized, open-labeled, controlled trial.

Setting: Tertiary care hospital.

Participants: 76 children (median age 12 mo) with clinical and radiologically confirmed rickets.

Intervention: Oral vitamin D3 as 300,000 IU (Group 1; *n*=38) or 600,000 IU (Group 2; *n*=38) in a single day.

Outcome variables: Primary: Serum 25(OH)D, 12 weeks after administration of vitamin D3; Secondary: Radiological healing and serum parathormone at 12 weeks; and clinical and biochemical adverse effects.

baseline value as co-variate) was 0.91 (95% CI: 0.65–1.29). Radiological healing occurred in all children by 12 weeks. Both groups demonstrated significant (P<0.05) and comparable fall in the serum parathormone and alkaline phosphatase levels at 12 weeks. Relative change [ratio of geometric mean (95% CI)] in serum PTH and alkaline phosphatase, 12 weeks after therapy, were 0.98 (0.7–1.47) and 0.92 (0.72–1.19), respectively. The serum 25(OH)D levels were deficient (<20 ng/mL) in 63% (38/60) children after 12 weeks of intervention [Group 1: 20/32 (62.5%); Group 2: 18/28 (64.3%)]. No major clinical adverse effects were noticed in any of the children. Hypercalcemia was documented in 2 children at 4 weeks (1 in each Group) and 3 children at 12 weeks (1 in Group 1 and 2 in Group 2). None of the participants had hypercalciuria or hypervitaminosis D.

Conclusion: A dose of 300,000 IU of vitamin D3 is comparable to 600,000 IU, administered orally, over a single day, for treating

Improvement in vitamin D level

Parameter Vitamin D3 (ng/mL)	Group 1 (n=32) mean (SD)	Group II (n=28) mean (SD)	*P*-value Group I vs Group II
Baseline	10.5 ±9.91	9.5±6.95	0.61
12 weeks	19.2 ± 12.13	22.8 ± 19.88	0.39
Change in Vitamin D3 (ng/mL)	8.3±15.18	13.4±20.96	0.28

Vitamin D status: baseline and after 12wk

25(OH)D3 levels (ng/mL)	Group I n (%)	Group II n (%)	P- value
≤ 5 (severe deficiency)			
Baseline	14/38 (36.8%)	13/38 (34.2%)	0.97
12 weeks	2/32 (6.3%)	0 (0%)	0.28
5.1-14.9 (moderate deficiency)			
Baseline	16/38 (42.1%)	17/38 (44.7%)	0.97
12 weeks	12/32 (37.5%)	16/28 (57.1%)	0.28
15-20 (insufficiency)			
Baseline	3/38 (7.9%)	4/38(10.5%)	0.97
12 weeks	6/32(18.8%)	2/28(7.1%)	0.28
≥ 20.1 (sufficient)			
Baseline	5/38(13.2%)	4/38(10.5%)	0.97
12 weeks	12/32(37.5%)	10/28(35.7%)	0.28

Hence both the doses improved the severe deficiency similarly.

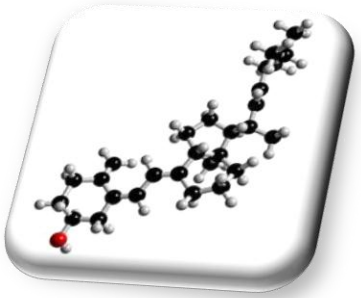
Treatment

Age	Daily dose for 90 days, IU	Single dose, IU	Maintenance single dose, IU
< 3months	2000	N/A	400
3 – 12 months	2000	50000	400
> 12 months to 12 y	3000 – 6000	150000	600
> 12 y	6000	300000	600

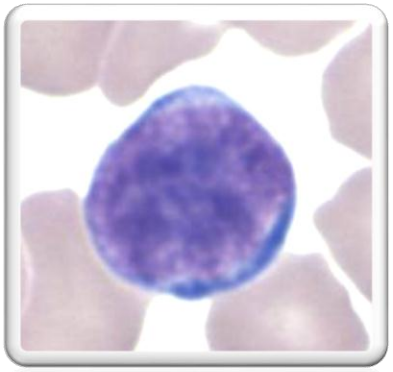
Vitamin D beyond rickets……

Vitamin D: modulator of the Immune System

Vit D

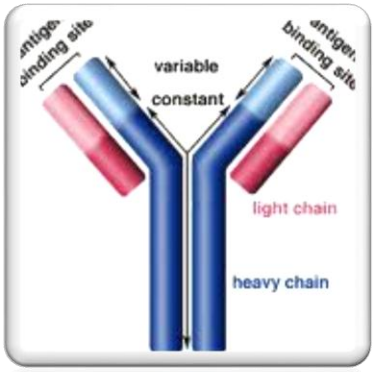


Immune modulating properties



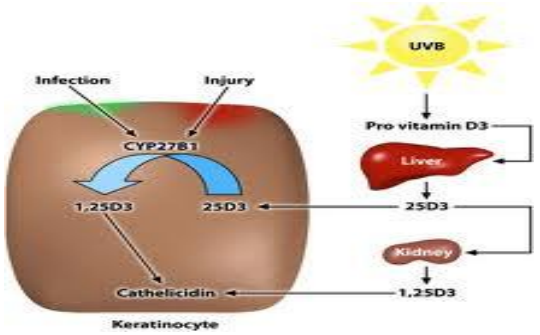
Inhibit lymphocyte proliferation

Induce monocye differentiation



↑ Naturally occurring Abs & cytokine

As an Antimicrobial



- Acts upon T and B cells and can modulate production of cytokines and antibodies
- Through enhanced expression of the human cathelicidin antimicrobial peptide (hCAP-18), is important in host defenses against respiratory tract pathogens.

- *Science. 2006;311:1770-3.*
- **Vitamin D, respiratory infections, and asthma.** Curr Allergy Asthma Rep. 2009 Jan;9(1):81-7

Vitamin D and Respiratory Tract

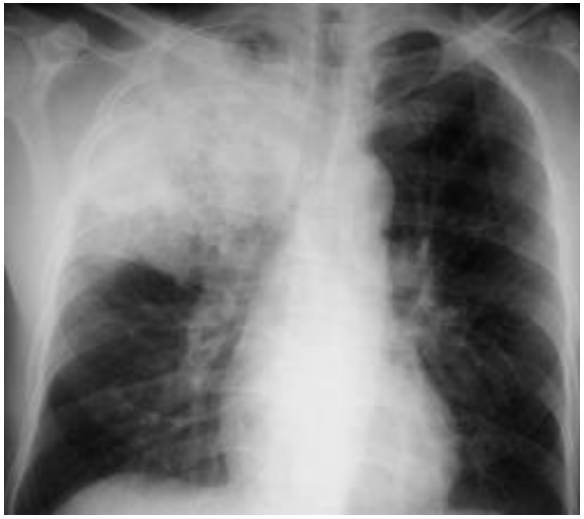
Recent research indicates that Vitamin D may have a potential role in protection from acute respiratory tract infections by increasing the body's production of naturally acting antibiotics.

Wayse V, Yousafzai A, Mogale K, et al. Association of subclinical vitamin D deficiency with severe acute lower respiratory infection in Indian children under 5 years.

Eur J Clin Nutr. 2004;58:563-7.

Vitamin D and Tuberculosis

- A Single Dose of Vitamin D Enhances Immunity to Mycobacteria



American journal of respiratory and critical care medicine, April 2007

Vitamin D and Asthma

vitamin D supplementation may lead to improved asthma control by inhibiting the influx of inflammatory cytokines in the lung and increasing the secretion of interleukin 10 by T-regulatory cells and dendritic cells.

The role of vitamin D in asthma: **Annals of Allergy, Asthma & Immunology** Volume 105, Issue 3 , Pages 191-199, September 2010

Supplementation advocated for prevention/therapy of respiratory infections

RESEARCH PAPER

Vitamin D Supplementation for Severe Pneumonia – *A Randomized Controlled Trial*

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Received: March 23, 2011; Initial review: April 13, 2011; Accepted: July 09, 2011.

Objective: To determine the role of oral vitamin D supplementation for resolution of severe pneumonia in under-five children.

Design: Randomized, double blind, placebo-controlled trial.

Setting: Inpatients from a tertiary care hospital.

Participants: Two hundred children [mean (SD) age: 13.9 (11.7) months; boys: 120] between 2 months to 5 years with severe pneumonia. Pneumonia was diagnosed in the presence of fever, cough, tachypnea (as per WHO cut-offs) and crepitations. Children with pneumonia and chest indrawing or at least one of the danger sign (inability to feed, lethargy, cyanosis) were diagnosed as having severe pneumonia. The two groups were comparable for baseline characteristics including age, anthropometry, socio-demographic profile, and clinical and laboratory parameters.

Intervention: Oral vitamin D (1000 IU for <1 year and 2000 IU for >1 year) (n=100) or placebo (lactose) (n=100) once a day for 5 days, from enrolment. Both the groups received antibiotics as per the Indian Academy of Pediatrics guidelines, and supportive care (oxygen, intravenous fluids and monitoring).

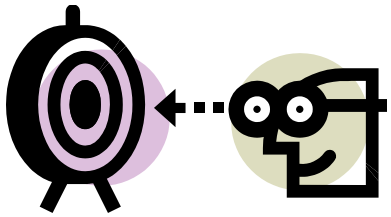
Outcome variables: *Primary*: time to resolution of severe pneumonia. *Secondary*: duration of hospitalization and time to resolution of tachypnea, chest retractions and inability to feed.

Results: Median duration (SE, 95% CI) of resolution of severe pneumonia was similar in the two groups [vitamin D: 72 (3.7, 64.7-79.3) hours; placebo: 64 (4.5, 55.2-72.8) hours]. Duration of hospitalization and time to resolution of tachypnea, chest retractions, and inability to feed were also comparable between the two groups.

Conclusion: Short-term supplementation with oral vitamin D (1000-2000 IU per day for 5 days) has no beneficial effect on resolution of severe pneumonia in under-five children. Further studies need to be conducted with higher dose of Vitamin D or longer duration of supplementation to corroborate these findings.

Key words: *ARI, India, Pneumonia, Treatment, Vitamin D.*

Published online: 2011 August 15. S097475591100214-1

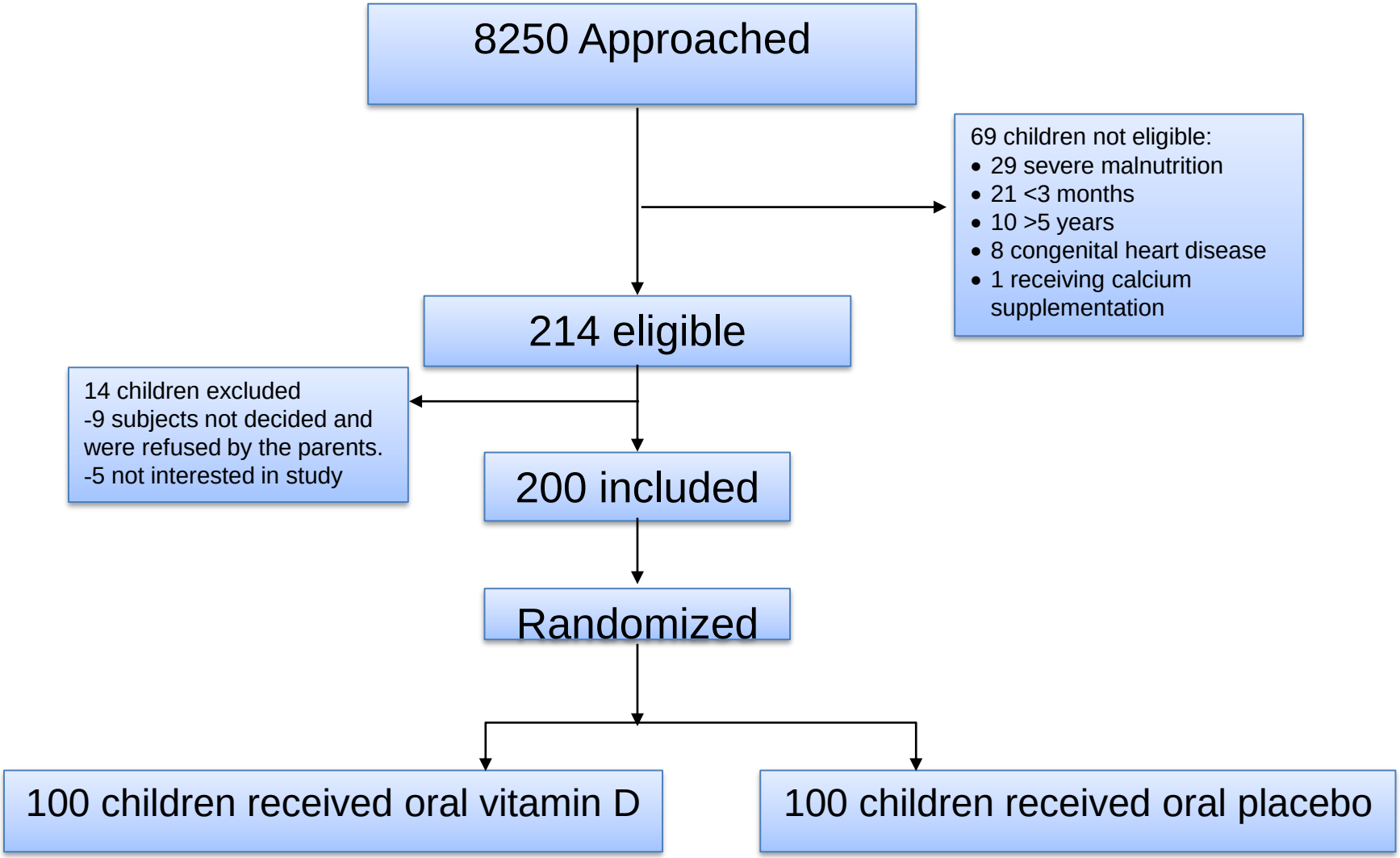


Aim

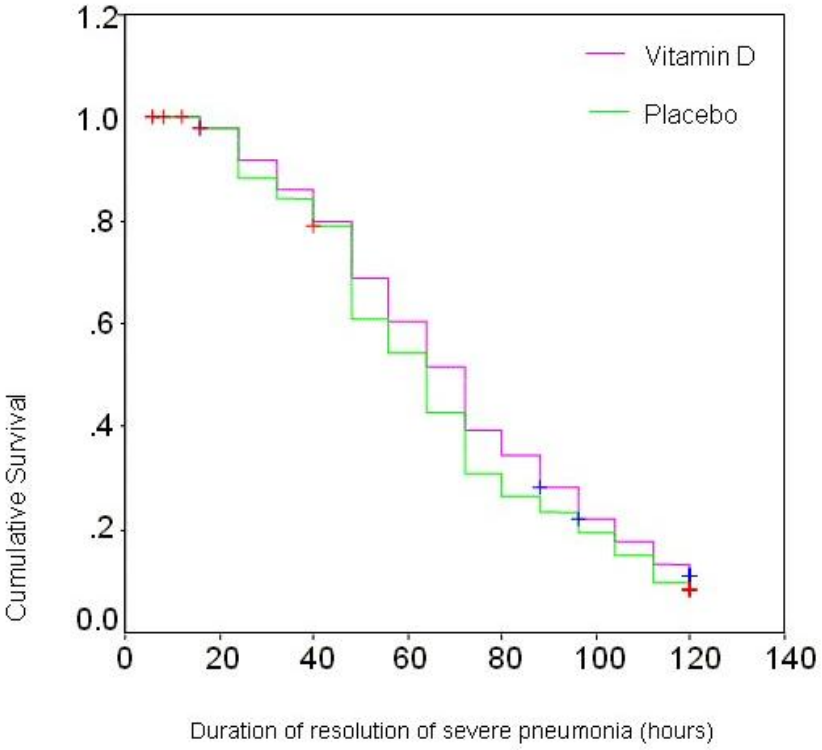
To study the efficacy of vitamin D supplementation for treatment of severe pneumonia in children under 5 years of age

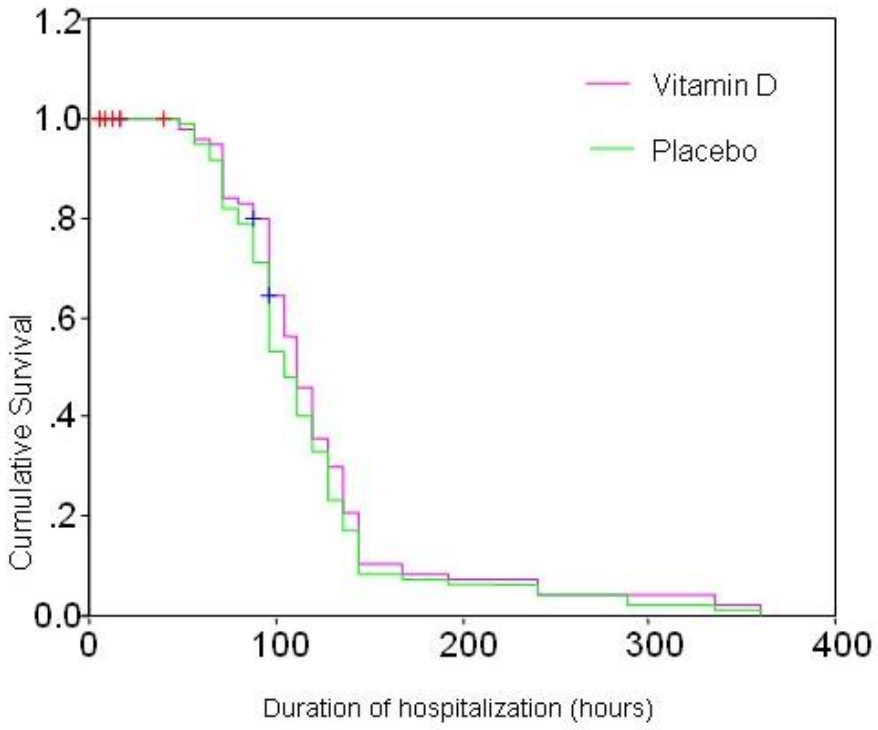
Intervention 1000-2000 IU/d*5d

2012


8250 Approached
69 children not eligible:
• 29 severe malnutrition
• 21 <3 months
• 10 >5 years
• 8 congenital heart disease
• 1 receiving calcium supplementation
214 eligible
14 children excluded
-9 subjects not decided and were refused by the parents.
-5 not interested in study
200 included
Randomized
100 children received oral vitamin D
100 children received oral placebo

Results





	Vitamin D	Placebo	P-value
Resolution of severe pneumonia (hrs)	72	64	0.33
Duration of hospitalization (hrs)	112	104	0.29

Summary

Short-term supplementation with vitamin D did not decrease the:

1. Duration of resolution of severe pneumonia
2. Duration of hospitalization and
3. Time taken for resolution of individual symptoms of severity of pneumonia

Limitations of the Study

- *Inability to measure vitamin D levels* – Recruited patients may include both vitamin D deplete and vitamin D replete children
- *Short duration of supplementation* may have failed to have the desired impact in depleted children
- *Doses could have been inadequate* to have the desired impact, specially in vitamin D depleted group
- No follow-up after 5 days (impact on recurrence of pneumonia not ascertained)

Vitamin D Supplementation for Severe Pneumonia in Under-five Children: A Double Blind, Randomized Placebo Controlled Trial

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Delhi, India

2013-2016

RESEARCH PAPER

Vitamin D Supplementation for Treatment and Prevention of Pneumonia in Under-five Children: *A Randomized Double-blind Placebo Controlled Trial*

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Received: June 21, 2016; Initial review: July 25, 2016; Accepted: August 11, 2016.

Objective: To evaluate the efficacy of single oral mega-dose of Vitamin D3 for treatment and prevention of pneumonia in under-five children.

Design: Randomized, double blind, placebo-controlled trial.

Setting: Tertiary-care hospital.

Participants: 324 children (of 980 assessed) between 6 mo-5 y age (median (IQR): 12 (7,19.8) mo) with WHO-defined severe pneumonia. Of these, 126 (39%) were vitamin D deficient (serum 25(OH)D <12 ng/mL).

Intervention: 100,000 IU of oral cholecalciferol (*n*= 162) or placebo (*n*= 162) in single dose, administered at enrolment.

Outcome variables: *Primary*: Time to resolution of severe pneumonia and proportion of children having recurrence of pneumonia in next 6 months; *Secondary*: Change in serum levels of 25(OH)D; immunoglobulins IgA, IgG, IgM, and cathelicidin 2 weeks following supplementation; and time taken for overall resolution of illness.

Results: Median (95% CI) time for resolution of severe to 31 (29,33) h in the placebo group [adjusted hazard ratio (95% CI): 1·39 (1·11, 1·76); *P*=0·005]. The risk of recurrence of pneumonia in next 6 months was comparable in the two groups [placebo: 36/158 (22·8%); vitamin D: 39/156 (25%); RR (95% CI): 1·13 (0·67,1·90); *P*=0·69]. Proportion of vitamin D deficient children declined from 38% to 4% in the supplementation group, and from 41% to 33% in the placebo group, two weeks after supplementation. There was no significant effect of vitamin D supplementation on serum levels of cathelicidin, IgA and IgG. The time taken for complete recovery from pneumonia, duration of hospitalization, and fever clearance time were comparable for the two groups. No adverse event was noted related to the intervention.

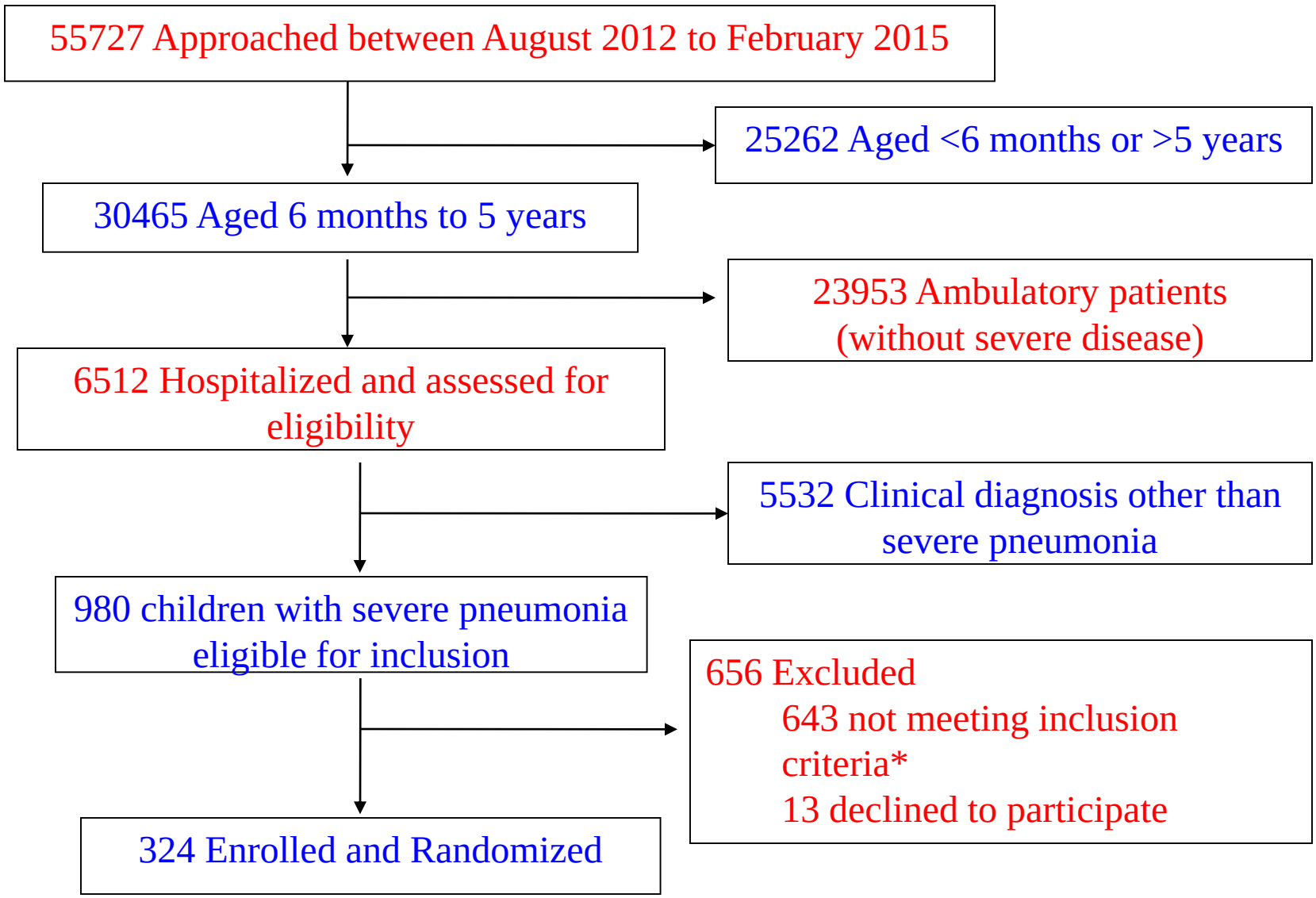
Conclusion: There is no robust evidence of a definite biological benefit, either for therapy or prevention, to suggest a routine megadose supplement of vitamin D3 for under-five children with severe pneumonia.

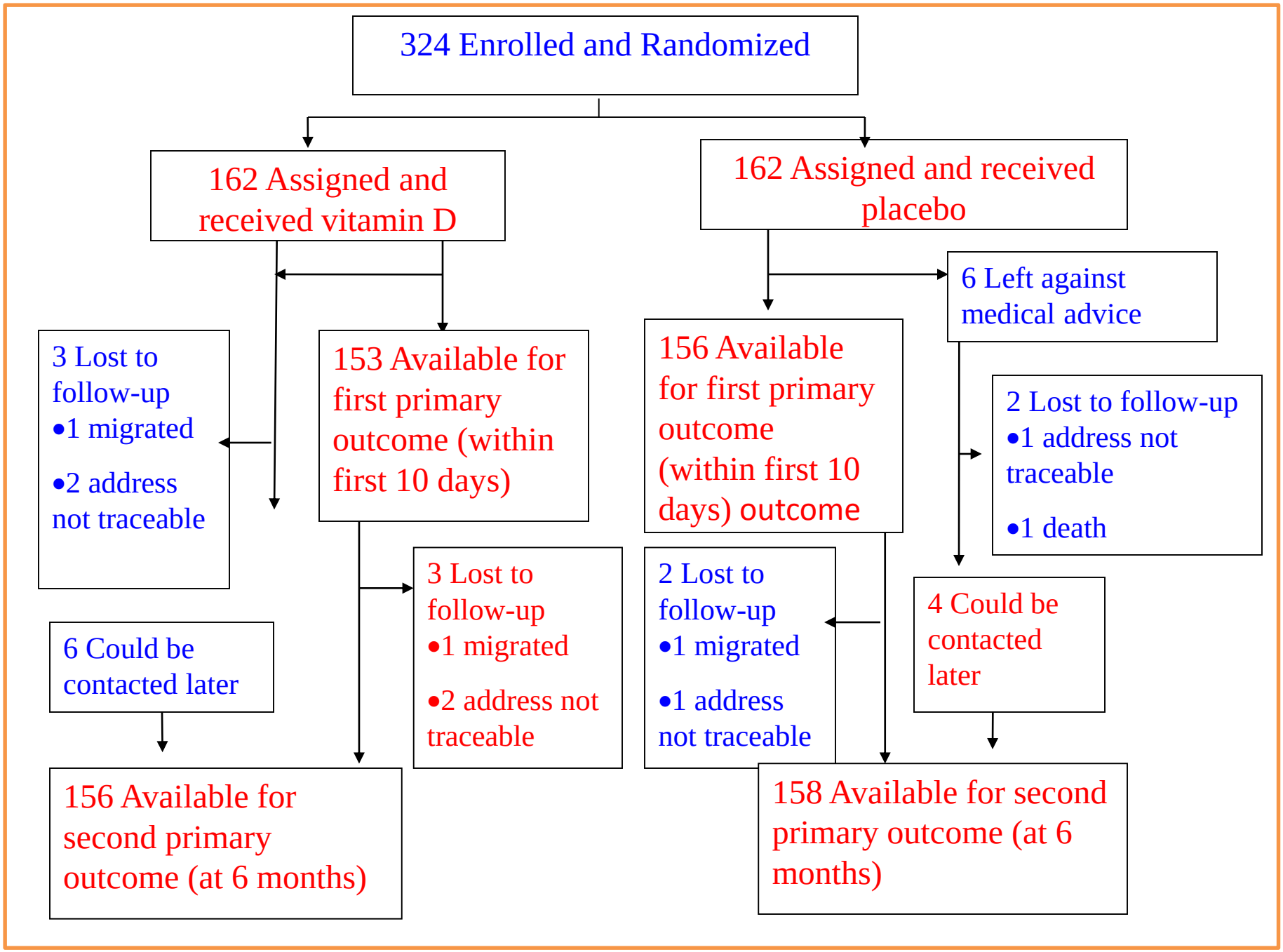
Keywords: *Cholecalciferol, LRTI, Micronutrient Therapy, Prevention, Outcome.*

Hypothesis

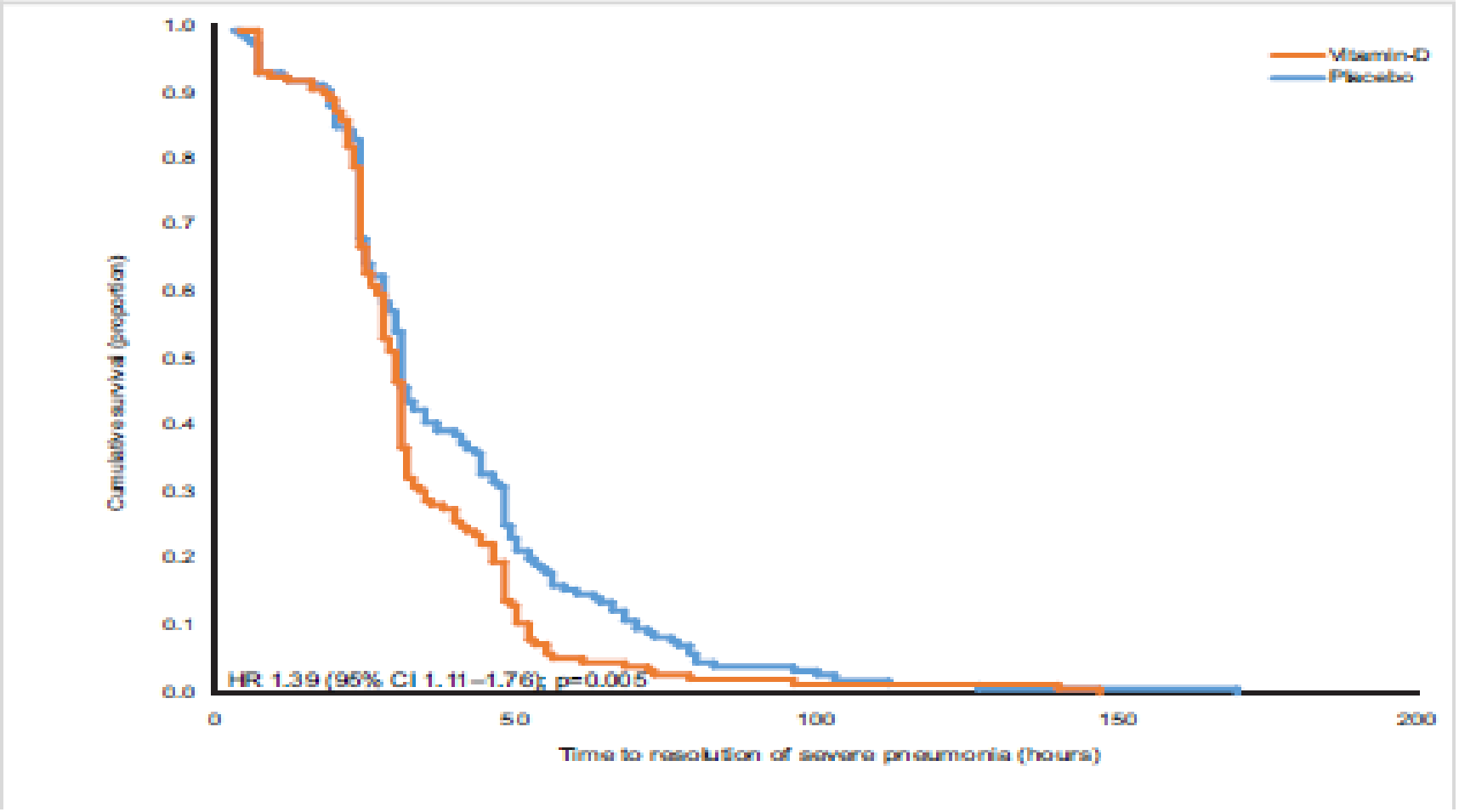
Oral Vitamin D supplementation (1 lac IU single dose) for severe pneumonia in children 6mo-5years will lead to at least 1 day reduction in the time to resolution of severe pneumonia and 30% relative reduction in proportion of children suffering from a repeat episode of pneumonia in the next 6 months.

***Figure* 1: Trial profile**

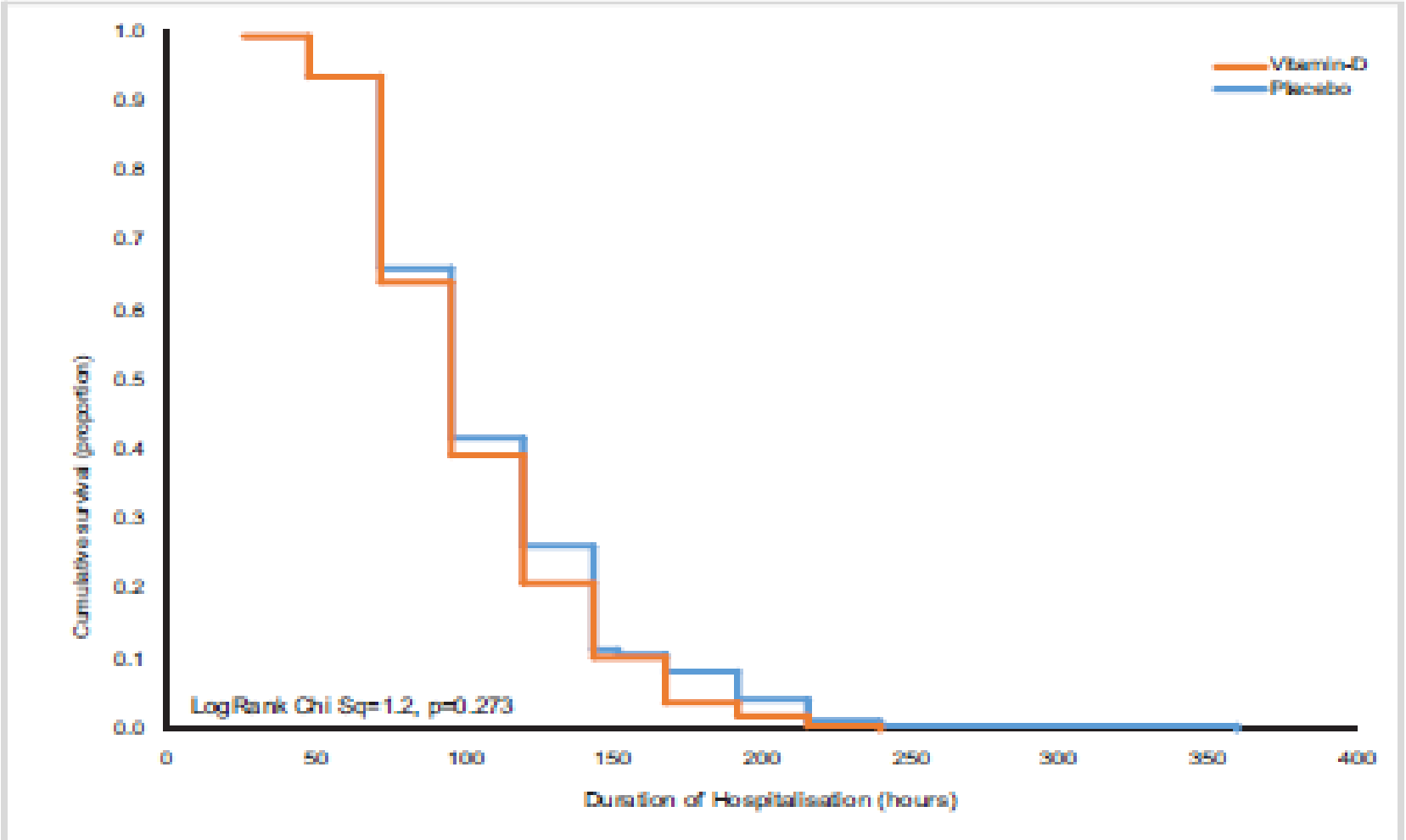



324 Enrolled and Randomized
162 Assigned and received vitamin D
162 Assigned and received placebo
3 Lost to follow-up
•1 migrated
•2 address not traceable
153 Available for first primary outcome (within first 10 days)
6 Left against medical advice
156 Available for first primary outcome (within first 10 days) outcome
2 Lost to follow-up
•1 address not traceable
•1 death
3 Lost to follow-up
•1 migrated
•2 address not traceable
2 Lost to follow-up
•1 migrated
•1 address not traceable
6 Could be contacted later
4 Could be contacted later
156 Available for second primary outcome (at 6 months)
158 Available for second primary outcome (at 6 months)

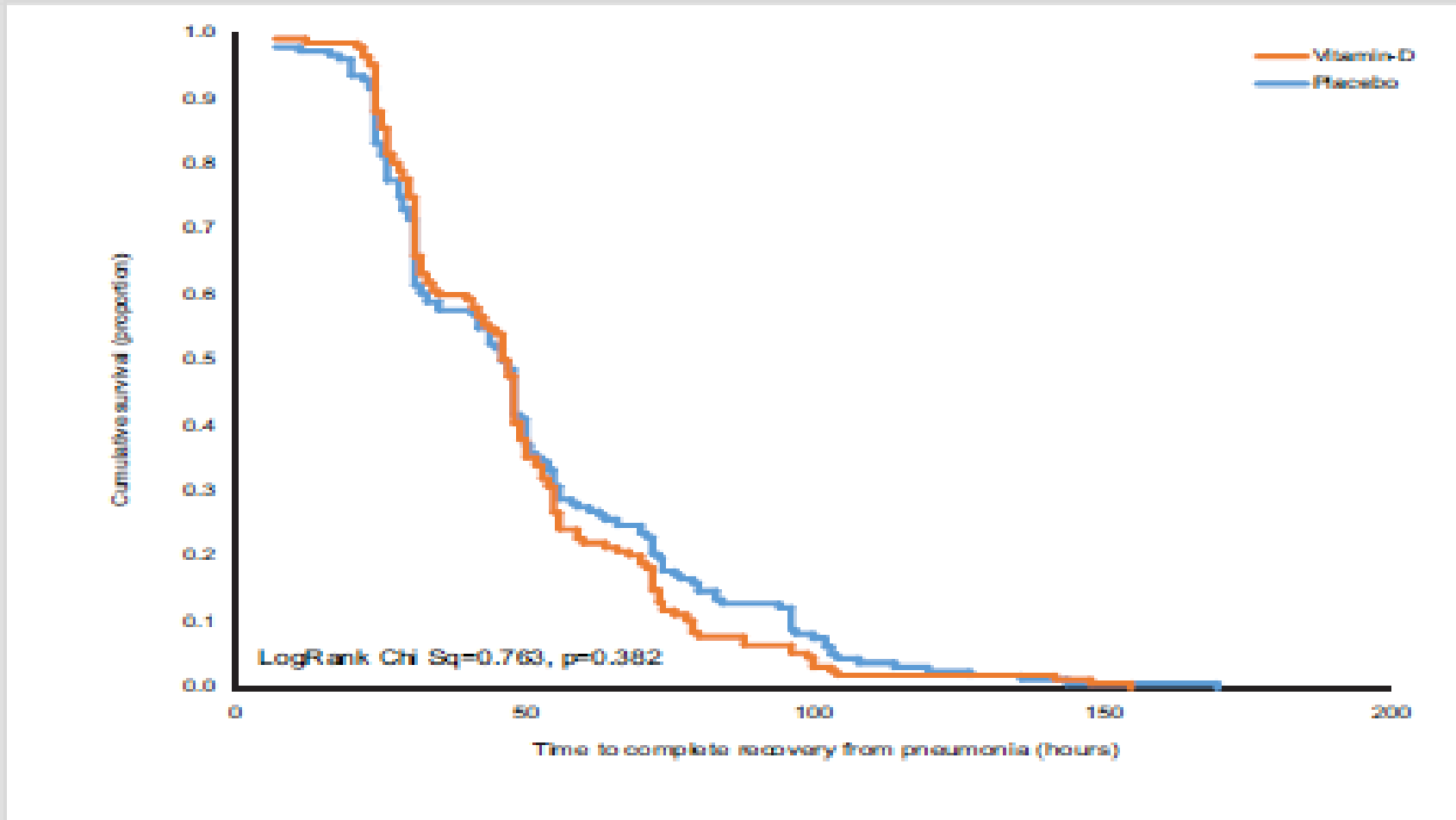
Time of resolution of severe pneumonia (hours)



Duration of Hospitalization (hours)



Time to complete recovery from pneumonia (hours)



Fever clearance time (hours)

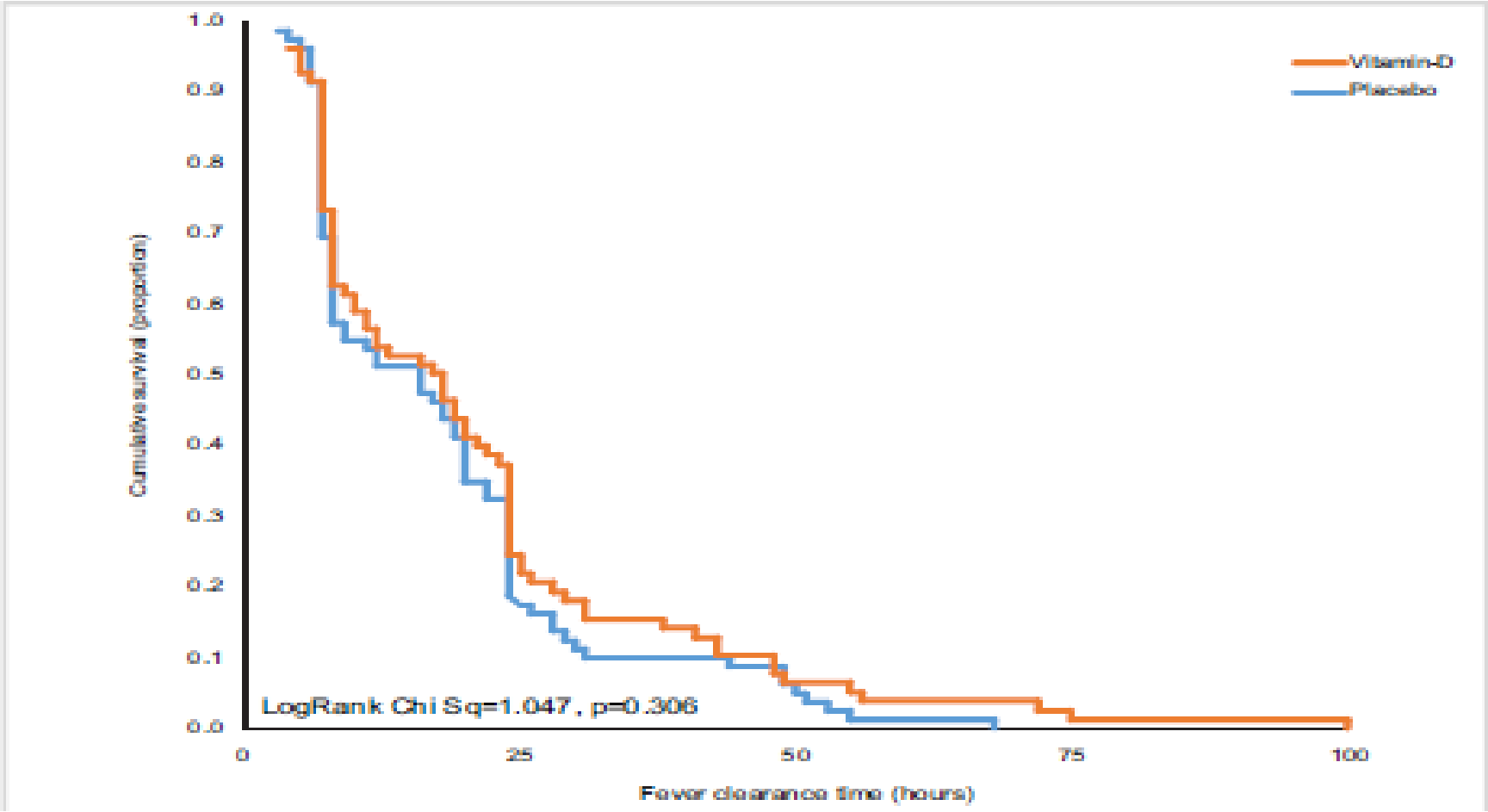


TABLE II Recurrence of Pneumonia in 6 Months Following The Resolution of the Initial Episode

Variable	***Supplementation group***		***P value***
	Vitamin D (n=156)	***Placebo (n+158)***	
Recurrence of pneumonia, n (%)	39 (25)	36 (22.8)	0.64
1 episode	29	27	
2 episode	7	6	
3 episode	3	2	
4 episode	0	1	

What This Study Adds

Vitamin D supplementation to children with pneumonia is neither clinically significant nor consistent to warrant routine supplementation of vitamin D in children below five years of age with pneumonia.

Consensus Statement

HORMONE RESEARCH IN PÆDIATRICS

Horm Res Paediatr
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Global Consensus Recommendations on Prevention and Management of Nutritional Rickets

Craig F. Munns Nick Shaw Mairead Kiely Bonny L. Specker Tom D. Thacher Keiichi Ozono Toshimi Michigami Dov Tiosano M. Zulf Mughal Outi Mäkitie Lorna Ramos-Abad Leanne Ward Linda A. DiMeglio Navoda Atapattu Hamilton Cassinelli Christian Braegger John M. Pettifor Anju Seth Hafsatu Wasagu Idris Vijayalakshmi Bhatia Junfen Fu Gail Goldberg Lars Sävendahl Rajesh Khadgawat Pawel Pludowski Jane Maddock Elina Hyppönen Abiola Oduwole Emma Frew Magda Aguiar Ted Tulchinsky Gary Butler Wolfgang Högler

Global consensus recommendations 2015

Section 2: Prevention and treatment of nutritional rickets and osteomalacia

2.1. Vitamin D supplementation for the prevention of rickets and osteomalacia

400 IU/d (10 μg) is adequate to prevent rickets and is recommended for all infants from birth to 12 months of age, independent of their mode of feeding. (1⊕⊕⊕)

Levels…..Global Consensus

Vitamin D status	Serum 25(OH)D level (ng/mL)
Deficiency	<12
Insufficiency	12-20
Sufficiency	>20
Excess	>100
Intoxication	>150

Munns CF, Shaw N, Kiely M, Specker BL, Thacher TD, Ozono K, et al. ***Global consensus recommendations*** *on prevention and management of nutritional rickets. Horm Res Paediatr. 2015;85(2):83–106.*

Growing advocacy for routine vitamin D supplementation but still no recommendations from GoI, ICMR, or IAP

Lack of literature on sensible sunlight exposure for prevention of vitamin D deficiency

Sunshine exposure and serum 25-hydroxyvitamin D concentrations in exclusively breast-fed infants

The relationship between serum 25-hydroxyvitamin D (25-OHD) concentrations and sunshine exposure in 61 term, exclusively breast-fed infants younger than 6 months of age was investigated. Sunshine exposure was quantitated using a sunshine and clothing diary, which was verified by infant-adapted ultraviolet dosimetry. By multiple regression techniques, infant serum 25-OHD concentrations were significantly related to UV exposure and maternal serum 25-OHD concentrations. Infant 25-OHD concentrations correlated with sunshine exposure in infants whose mothers had low (<35 ng/ml) or high (>35 ng/ml) serum concentrations of 25-OHD ($r = 0.70$, $P < 0.001$ and $r = 0.53$, $P = 0.004$, respectively). Estimates were made to determine sunshine exposure conditions necessary to maintain serum 25-OHD concentrations above the lower limit of the normal range (11 ng/ml). A conservative estimate would be 30 minutes per week wearing only a diaper or 2 hours a week fully clothed without a hat. (J PEDIATR 1985;107:372-376)

Bonny L. Specker, Ph.D., Barbara Valanis, D.P.H., Vicki Hertzberg, Ph.D., Neil Edwards, M.S., and Reginald C. Tsang, M.B.B.S.

Research Questions

Does sunlight exposure actually predict serum vitamin D levels in Indian infants?

If yes, how much sunlight exposure and duration is optimal for adequate serum
vitamin D levels in infants in India.

Are the infants getting the desired exposure to sunlight?

RESEARCH PAPER

Sunlight Exposure and Vitamin D Status in Breastfed Infants

PINKY MEENA, AASHIMA DABAS, DHEERAJ SHAH, #RAJEEV KUMAR MALHOTRA, *SV MADHU AND PIYUSH GUPTA

*From the Departments of Pediatrics, #Biostatistics and Medical Informatics, and *Medicine (Division of Endocrinology); University College of Medical Sciences and Guru Teg Bahadur Hospital, Dilshad Garden, Delhi, India.*

Correspondence to: Dr Piyush Gupta, Professor of Pediatrics, University College of Medical Sciences and GTB Hospital, Dilshad Garden, Delhi 110 095, India. prof.piyush.gupta@gmail.com

Received: July 18, 2016; Initial review: August 31, 2016; Accepted: November 30, 2016.

Objective: To correlate the sunlight exposure in first 6 months to vitamin D status at 6 months of age in predominantly breastfed infants; and to quantify the sunlight exposure required to achieve serum 25(OH)D level >20 ng/mL, by 6 months of age

Design: Prospective cohort.

Setting: Tertiary-care hospital predominantly catering to urban poor population in Delhi.

Participants: 132 healthy infants, delivered at term, and predominantly breastfed were enrolled at 6-8 weeks of age. Of these, 100 infants were available for final evaluation at 6 months of age (mean (SD) follow-up: 126 (17) days).

Methods: Baseline maternal vitamin D (serum 25(OH)D) levels were obtained at enrolment. The mothers were asked to maintain a daily record of duration of sunlight exposure, timing of exposure, and body surface area exposed, for the infant, on a pre-designed levels, season of exposure, and skin color of the infant. Sun index for exposure in morning (before 10 am) and afternoon (10 am-3 pm) were also correlated to vitamin D status.

Results: Of 100 mother-infant pairs completing the study, 90 mothers had vitamin D deficiency (serum 25(OH)D <12 ng/mL). The median duration of exposure of infants to sunlight was 17 min per week, on 6% of body surface area. Vitamin D levels of 67 (67%) infants at 6 months were less than 12 ng/mL and another 23% had insufficient levels (12-20 ng/mL). Cumulative sun index correlated positively to infant's serum 25(OH)D level at 6 months of age (r= 0.461, P<0.001). Increment in afternoon sun index by 1 unit increased the serum 25(OH)D level by 1.07 ng/mL (95% CI 0.37, 1.78; P= 0.003). A minimum 30 minute weekly afternoon sunlight exposure, between 10 am and 3 pm, over 40% body area (infant clothed in diapers, in prone position) for at least 16 weeks, was estimated requirement to achieve sufficient vitamin D levels

Methodology

Study Design : Descriptive cohort study

(follow-up of six months)

Setting : Home based sunlight exposure and outpatient based data collection.

Participants : Healthy predominantly breastfed infants, born term, enrolled at 6-8 weeks of age

.

Flow of study

Total subjects approached - 300

Home delivered – 39
Residing >5 km from hospital – 34
Preterm delivery – 31
Refused to participate – 27
NICU admission- 21
Low birth weight (<2.5 kg) -16

132 babies found eligible- Enrolled after consent

6 months follow up

32 babies lost to F/up

Change residence – 9
Hospitalization – 8
Change of immunization place – 5
Developed rickets – 1
Refused for follow up - 9

100 mother-baby pairs available for final analysis

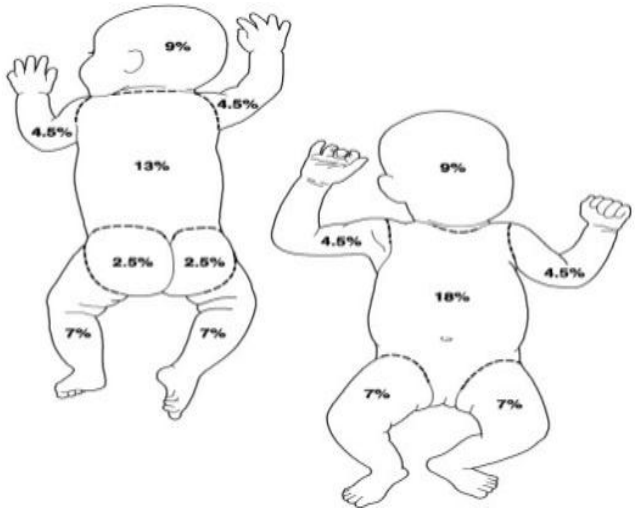
Baseline characteristics of study population

Parameter	Infants completed study (n=100)	Infants lost to follow up (n=32)	P value
Age (days)	48 (46-52)	51(50-56)	**0.001**
Birth weight (kg)	2.8 (2.5-3.0)	2.8 (2.6-2.8)	0.78
Anthropometry			
Weight-for-age Z-score	-1.0(-1.64 to -0.46)	-0.32 (-0.55 to 0.07)	**<0.001**
Length-for-age Z-score	-0.35 (-0.97 to 0.19)	0.28 (-0.20 to 0.68)	**<0.001**
Weight-for-length Z-score	-1.14 (-1.61 to -0.63)	-0.55 (-1.09 to -0.06)	0.002
Skin Fitzpatrick Score			
Score 3	74(74%)	26(81%)	0.48
Score 4	26(26%)	6(19%)	
Antenatal calcium supplementation	93(93%)	31(97%)	0.68
Duration of antenatal calcium supplementation (d)	68(29.5) (n=93)	41(17) (n=31)	**<0.001**
Maternal serum 25(OH)D (ng/mL)	**6.30 (4.39 – 8.06)**	**3.56 (2.24 – 7.91)**	0.19

Sun Exposure Documentation

Lund and Browder' chart

- Mothers educated to record data weekly
- Marking done once a day/ week: 5-6 forms/ month/ child.
- Compliance – Telephonically, personally at follow up visits.
- **Follow up done at 2.5, 3.5 and 6 months.**

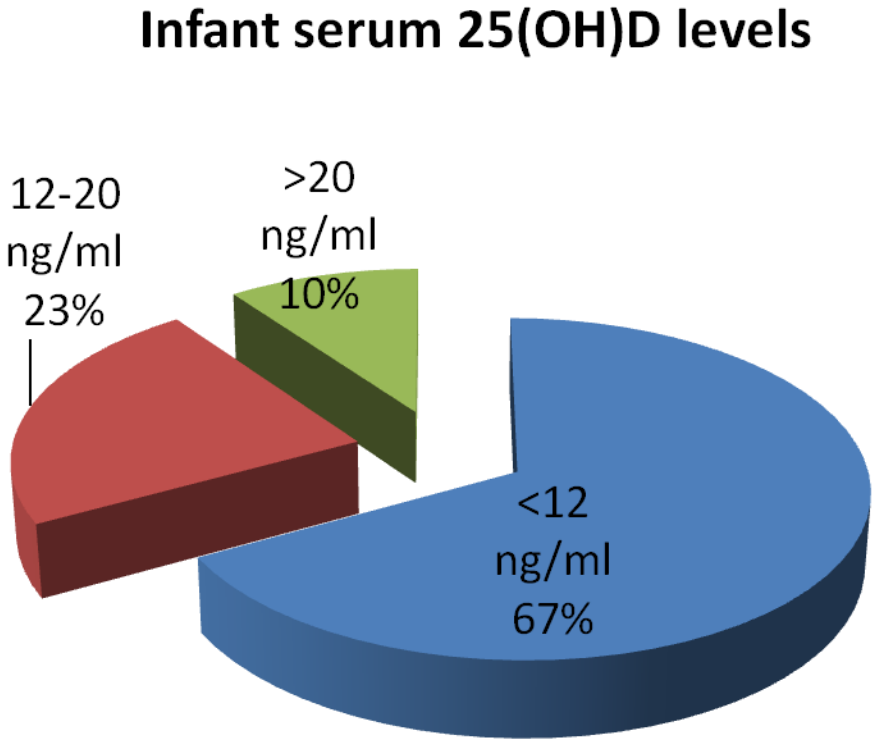
Body surface area	Time of day	Duration		
		<30 min	30 – 60 min	> 60 min
	7 AM - 10 AM			
	10 AM – 3 PM			
	3 PM – 6 PM			

Results- Sun exposure

- Median Weekly Sunlight exposure:
  - Morning before 10 am -**11 minutes** (IQR 9,15)
  - Afternoon between 10 am to 3 pm- 5 minutes (IQR 3,9)
- Average fraction of body surface area (BSA) exposed - **6.8%** (IQR 4.6, 7.4%).

Results- Vitamin D

- VDD in 67% infants
- Mean infant serum 25(OH)D level at 6 months
  - Mean= 10.9 (SD 5.6) ng/mL
  - Median= 9.2, IQR 7.34-13.36) ng/mL



Sun index predicting serum 25(OH)D

Significant positive correlation between infant's serum 25(OH)D level and cumulative sun index (0.461, $p<0.001$).

Sunlight exposure duration and fraction of body surface area exposed – independently correlated with infant's serum 25(OH)D level (0.4 and 0.459 respectively ; $p < 0.001$)

To postulate further..

Afternoon sun index increase by 1 unit - **increased infant's 25(OH)D level by 1.07 units.**

To attain infant serum 25OHD as 20ng/mL, **additional 13 units** of afternoon sun index required

(25th centile of Serum 25OHD= 7ng/mL)

Assuming minimum BSA exposed as 0.4 (if the child lies prone exposed to sun required with diapers

Duration of afternoon sunlight to produce sun index as 1 will be **2.5 minutes**

To achieve increase in sun index by 13 units : **afternoon sunlight exposure of approximately 30 minutes per week is required**

(SI= duration x BSA)

Conclusions

- There is a significant correlation between sunlight exposure and serum 25OH vitamin D in breastfed infants at 6 months of age.
- Afternoon sun exposure of 30 minutes per week over 40% exposed body surface can achieve sufficient vitamin D (20 ng/mL) in infants at 6 months of age ***irrespective of maternal vitamin D levels***

Research Questions: Did we get some answers?

Does sunlight exposure actually predict serum vitamin D levels in Indian infants?

If yes, how much sunlight exposure and duration is optimal for adequate serum
vitamin D levels in infants in India.

Are the infants getting the desired exposure to sunlight?

Discussion

Strengths of study

- First study on Indian infants
- Quantified sun exposure
- Pilot study for recommending sunlight exposure
- Analyzed possible confounders:
  - Maternal Vitamin D status
  - Season of enrolment
  - Skin colour

Limitation

- No baseline infant serum 25OHD (maternal levels considered proxy)
- Self reported questionnaire (considered valid across various studies)
- Lack of UV-B dosimetry
- Sample size

News

30 MINUTES OF SUNBATH A WEEK CAN MAKE INFANTS VITAMIN-D SUFFICIENT: NEW STUDY

written by Yogesh Sharma | September 15, 2017

A study from Delhi has suggested an estimate for the minimum duration for which infants need to be exposed to sunlight every day to achieve sufficient levels of vitamin-D in their body.

By Bhavya Khullar

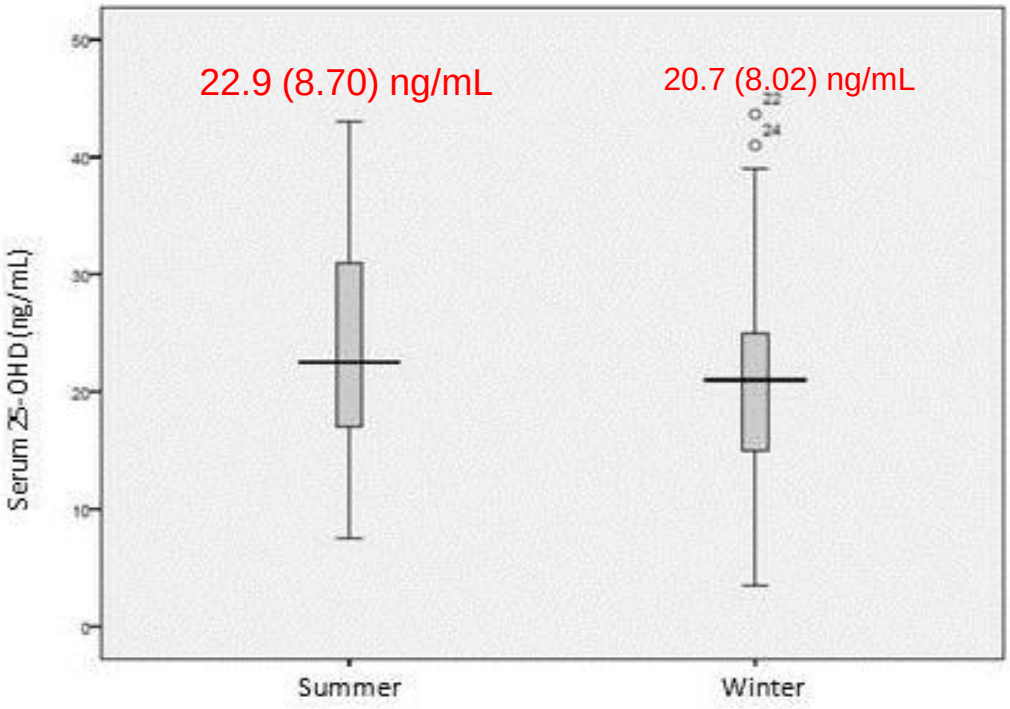
New Delhi, September 15: It used to be a routine practice in India to massage infants and give them a sunbath. But changing lifestyles in recent decades have confined kids to indoors. This has led to the emergence of Vitamin D deficiency as a major problem among infants.

Seasonal variation in serum 25 hydroxy-vitamin D and its association with clinical morbidity in healthy infants from northern India

- To measure the seasonal variation in serum 25-OHD levels among Indian infants.
- To determine whether seasonal change in vitamin D nutriture has any implication for common childhood morbidities.
- Year 2016-2017

Methodology

- Prospective cohort
- 72 healthy breastfed infants age 9-10 mo
- Followed up for 6 months
- Measured serum 25OHD at baseline and at 6mo
- Recorded incidence of childhood morbidities- fever, ARI, diarrhea, meningitis and seizure



- Mean seasonal difference in S. 25OHD of 2.14 ng/mL (95% CI: –3.36, –1.06; P<0.001).

GUIDELINES

Prevention and Treatment of Vitamin D and Calcium Deficiency in Children and Adolescents: Indian Academy of Pediatrics (IAP) Guidelines

ANURADHA KHADILKAR, VAMAN KHADILKAR, JAGDISH CHINNAPPA, NARENDRA RATHI, RAJESH KHADGAWAT, S BALASUBRAMANIAN, BAKUL PAREKH AND PRAMOD JOG

From Indian Academy of Pediatrics 'Guideline for Vitamin D and Calcium in Children' Committee.

Correspondence to: Dr. Anuradha Khadilkar, Deputy Director and Consultant Pediatrician, Hirabai Cowasji Jehangir Medical Research Institute, Jehangir Hospital, Pune, India. anuradhavkhadilkar@gmail.com

Received: November 26, 2016; Initial review: January 10, 2017; Accepted: May 20, 2017.

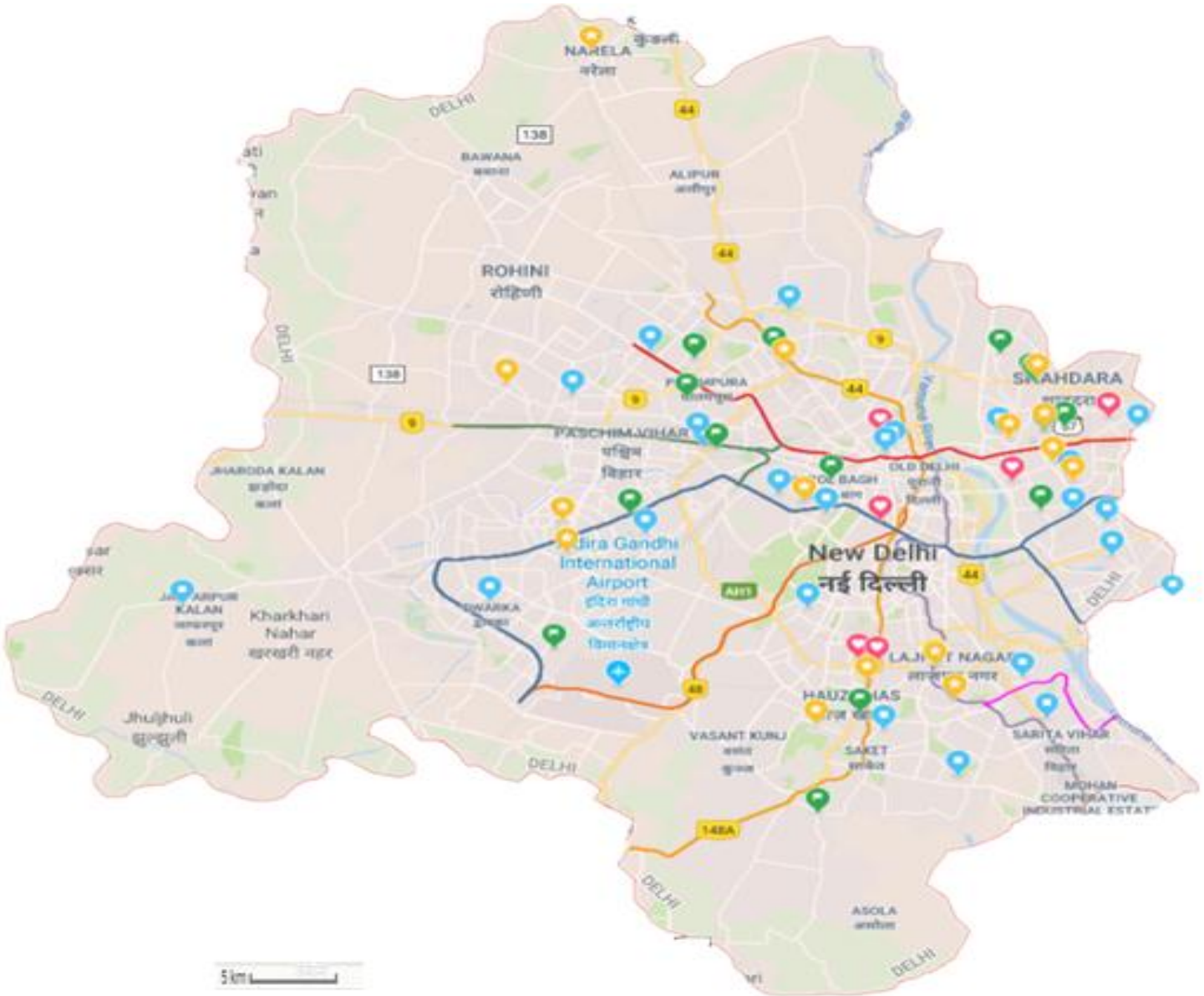
Justification: Vitamin D deficiency (VDD) is being increasingly reported from India from all age-groups. Reports suggest that VDD affects all age groups, from neonates to adolescents. Further, habitually low calcium intakes are also reported in Indian children. Given the multiple guidelines, peculiarities of Indian circumstances, changing lifestyles, and lack of fortification, the Indian Academy of Pediatrics (IAP) felt the need for a Practice Guideline for Pediatricians for the prevention and treatment of vitamin D and calcium deficiency in children and adolescents.

Process: The 'Guideline for Vitamin D and Calcium in Children' committee was formed by the IAP in September 2016. A consultative committee meeting was held in November 2016 in Mumbai. Evidence from Indian and international studies and other previous published recommendations, which were pertinent to the Indian circumstances, were collated for the preparation of these guidelines.

Objectives: To present a practice guideline for pediatricians for the prevention and treatment of deficiency of vitamin D and calcium in the

Prophylactic Vitamin D Supplementation To Infants: A Survey of Pediatricians In Delhi

(2017)



	7 Medical Colleges (32 pediatricians)		12 Delhi Government Hospitals (35 pediatricians)
	22 Private Clinics (22 pediatricians)		13 Private, 10 Corporate, 3 Trust/NGO Hospitals (14, 18, 4 pediatricians respectively)

Result

	Source of funding to health facility				
	Government (N'=67)		Private (N'=58)		
	N	n(%)	N	n(%)	**P-value**
Routine vitamin D supplementation given					
Term AGA infants [n(%)]	67	48 (71.64)	58	53 (91.36)	0.005
Term LBW infants [n(%)]	67	60 (89.55)	58	58 (100)	0.015
Preterm infants [n(%)]	67	64 (95.52)	58	58 (100)	0.248
Dose of vitamin D supplementation (400 IU)					
Term AGA infant	48	45 (93.75)	53	41 (77.36)	0.026
Term LBW infant	60	52 (86.67)	58	38 (65.52)	0.007
Preterm infants	64	34 (53.13)	58	22 (37.93)	0.093
Duration of vitamin D supplementation (months)					
Term AGA infants					
• **Less than 12**		12 (25)		8 (15.09)	
• **Equal to/more than 12**	48	36 (75)	53	45 (84.91)	0.212
Term LBW infants					
• **Less than 12**		16 (26.67)		10 (17.24)	
• **Equal to/more than 12**	60	44 (73.33)	58	48 (82.76)	0.217
Preterm infants					
• **Less than 12**		15 (23.44)		5 (8.62)	
• **Equal to/more than 12**	64	49 (76.56)	58	53 (91.38)	0.027

• Proportions are compared with Pearson's Chi Square Test

The New Research Question

Does prescription of routine supplementation of vitamin D for 1 year translate into actual consumption of the same?

More Unanswered Questions??

- What level of Vitamin D is adequate?
- What do we really know about sunshine, prevention of rickets, and risks of skin cancer?
- How much does skin pigmentation alter the dose?
- Are the benefits of supplementation worth the expense?
- Can we substitute routine vitamin D supplementation by sensible sunlight exposure during infancy?

Planned Study

Sunlight exposure vs. oral vitamin D supplementation for prevention of vitamin D deficiency in infants: *a randomized controlled study*

Goal: To make recommendations on appropriate sunlight exposure in infancy

Results expected: 2020 April

Dedicated to the Team









THANK YOU

So, when Jaadu kept asking for Dhoop... sunshine), He actually meant Vitamin D!!!