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Vitamin D Prevalence among Older Adults Hospitalized in a French Geriatric Hospital

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Abstract

Background: Vitamin D deficiency is associated with harmful impacts on various organism functions. This is particularly the case for the elderly who have higher risk of developing a vitamin D deficiency because of low sunlight exposure, inadequate nutrition, and age-related physiological changes. The aim of this study was to determine the prevalence of vitamin D deficiency in older inpatients.

Methods: Retrospective study was conducted at a French geriatric hospital among adults (>65 years) having a vitamin D serum dosage. A total of 149 participants were included in the study. The demographic data (age and sex), body mass index (BMI), presence of fracture, medication of antiepileptic and glucocorticoid, calcium and phosphorus blood values, serum albumin value, and vitamin D treatment initiation were performed during the study period.

Results: The study population was between 65 to 100 years old with a mean vitamin D level of 18.7 ± 11.8 µg/L. In total, 29.5% patients demonstrated severe vitamin D deficiency (<12.0 µg/L) and 59% patients demonstrated vitamin D deficiency (12-30 µg/L). Statistical significant correlation was found between the calcium and vitamin D level (Pearson coefficient=0.2669, p=0.006982) and gender and vitamin D level (Mann-Whitney test, p=0.04). Hypocalcaemia (<2.2 mmol/L) was found in 11.4%. For many patients (76%), vitamin D supplementation was initiated according to the local protocol (100,000 IU of cholecalciferol every 15 days for 2 months). For any patient, vitamin D blood control was performed.

Conclusions: Prevalence of vitamin D deficiency among older adults is considerably high often associated with reduced calcium levels. The current results suggest that vitamin D supplementation would be started in this risk group associated with a blood examination at the end of treatment to ensure its effectiveness.

Keywords: Vitamin D Deficiency; Older Adults; Supplementation; Prevalence; Inpatients

Abbreviations

- 25(OH) D: 25-hydroxyvitamin D
- IOM: Institute of Medicine
- EFSA: European Food Safety Authority
- ANSES: Agency for food, environmental and occupational health and safety
- BMI: body mass index

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Introduction

Vitamin D, a fat-soluble hormone, originates 80-90% from cutaneous biosynthesis under the effect of the ultraviolet rays of the sun. Only 10-20% of vitamin D is supplied by the absorption of food which naturally rich in this vitamin [1, 2]. The production of endogenous vitamin D is affected mainly by age, ethnic origin, availability of pro-vitamin D3, seasonal variations in sunlight, and the duration of exposure to the sun [3]. Main dietary vitamin D intakes include fatty fish, fish liver oil, eggs, cheese and milk products, particularly fortified products and certain mushrooms [4]. For adults, adequate intakes for vitamin D is set by the Institute of Medicine (IOM) and the European Food Safety Authority (EFSA) at 15 µg/day based on an adjusted model of the meta-regression analysis of serum 25-hydroxyvitamin D (25(OH) D) concentration according to total vitamin D intake [5, 6]. However, recommendations of dietary reference values for vitamin D for older adults aged over 65 range from 10 to 20 µg/day depending on the country [5]. In France, the National Agency for food, environmental and occupational health and safety (ANSES) reported actual nutritional reference of 15 µg/day for vitamin D [7]. At this vitamin D intake of 15 µ/day, the serum 25(OH)D concentration target was achieved at 20 µg/L (50 nmol/L) for the majority of the older population [5]. However, for patients with chronic diseases for which beneficial effects of vitamin D were suggested by observational studies, most experts were divided between setting a minimum concentration of 20 µg/L or 30 µg/L [8, 9]. Obtaining and maintaining a sufficient serum level of 25(OH)D remains crucial, since vitamin D has beneficial effects beyond musculoskeletal health, and potentially on other health aspects due to its immune modulatory properties, notably in older people with vitamin D deficiency [10]. For the elderly, the accent was placed on the reduction age-related loss of bone mass, the risk of bone fractures, skeletal muscle function and related risks of falls [5, 11]. Vitamin D is crucial to calcium and phosphorus homeostasis contributing to bone mineral density. Its deficiency in seniors that are often malnourished or at risk of becoming malnourished may contribute to the risk of fractures [12]. In addition to its known effects, vitamin D receptor is relatively ubiquitous in the organism and implicated in numerous physiological processes such as skeletal muscle development, cell regulation, immune system activity, autoimmune responses and inflammatory processes, brain development, peripheral neuronal activity, control of insulin secretion and the renin-angiotensin system, and cardiovascular function [13-21]. Older adults are prone to vitamin D hypovitaminosis because of low sun exposure notably in institutions, a poor diet, age-related physiological changes and medication such as antiepileptics and glucocorticoids [22]. With the negative consequences of vitamin D deficiency recognized for decades, studies and assessments are required, particularly for high-risk groups like elderly people who are hospitalized or institutionalized. The aim of this retrospective study was to determine the prevalence of vitamin D deficiency in older patients admitted to a French geriatric hospital.

Materials and Methods

Study design

An institutional board-approved retrospective review of older patients seen in our French geriatric hospital was performed from January 2019 to June 2023. Inclusion criteria included all patients up to 65 years old that had a vitamin D dosage at their hospital admission. The demographic data (age and sex), body mass index (BMI), presence of fracture, medication of antiepileptic and glucocorticoid, calcium and phosphorus blood values, serum albumin value, and vitamin D treatment initiation were performed during the study period.

Study protocol

Patients were selected using a patient cohort visualization tool (cohort360, health database of Assistance Publique des Hôpitaux de Paris declared with the French national data protection authority CNIL, authorization n° 1980120) which powerful queries directly in medical records. For the cohort, the physician requested vitamin D dosage routinely on patient admission. Its dosage guides vitamin D supplementation according to a local protocol. Patients who were vitamin D deficient (<30 µg/L) were treated with 100,000 IU of vitamin D3 (cholecalciferol) every two weeks. In our study, a vitamin D deficiency was defined by a vitamin D level ranged from 12 to 30 µg/L and a severe deficiency by a vitamin D level lower than 12 µg/L, according to the most frequently used thresholds [23].

Vitamin D determinations

Serum vitamin D (25(OH)D) was determined by electrochemiluminescence immunoassay (Elecsys vitamin D total III, Cobas Roche) from fasting venous blood samples. The lower limits of detection and quantitation for serum vitamin D was 3.0 µg/L and 6.0 µg/L, respectively. For patients in whom vitamin D levels were undetectable, a value of 3.0 µg/L was assigned for statistical calculations. Calcium (reference range 2.20-2.55 mmol/L) and phosphorus (reference range 0.81-1.45 mmol/L) levels were determined from blood serum samples.

Data analysis

Quantitative variables were reported as mean and standard deviation (SD) and qualitative variables as absolute proportion and percentage. The Pearson correlation coefficient was used to determine the correlation between vitamin D levels and age, BMI, and calcium and phosphorus

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levels. The Mann-Whitney test was used to compare the vitamin D level median according to sex. The alpha risk was set to 0.05. Statistical analysis was performed with Microsoft Excel 2016 (Microsoft Corporation, Santa Rosa, California). The percentage of patients according to categories of vitamin D status was calculated.

Results

Based on collected data, a total amount of 149 patients were included in the study. The study population was between 65 to 100 years old with a mean age of 83.9 ± 7.8 years. The gender balance was 95 women (64%) and 54 men (36%). Demographic and clinical characteristics of the study sample are supplied in Table 1. The study sample had a mean vitamin D level of 18.7 ± 11.8 µg/L with extrema from 3.0 to 91.2 µg/L. In total, 44 (29.5%) patients demonstrated severe vitamin D deficiency (<12.0 µg/L) of which 8 patients presented undetectable levels (<3.0 µg/L) and 88 (59%) patients demonstrated vitamin D deficiency (12-30 µg/L). The mean and the median of the serum vitamin D level were higher in women than in men (p = 0.025) (Fig. 1). Pearson correlation results between vitamin D levels and demographic data or other laboratory analyses such as calcium and phosphorus levels are reported in Table 2. Marked values are statistically significant. Statistical significant correlation was found between the calcium and vitamin D level (Pearson coefficient=0.2669, p=0.006982) and gender and vitamin D level (Mann-Whitney test, p=0.04). This relationship between the calcium and vitamin D level was showed in Fig. 2. There was no significant correlation between age, BMI or phosphorus level. Most patients (86.6%) had serum calcium levels within the normal range. However, hypocalcaemia (<2.2 mmol/L) was found in 11.4%, whereas just three patients (2.0%) were affected by hypercalcemia (>2.55 mmol/L). In all, 8 patients had a fracture, 3 patients received antiepileptic treatment (lamotrigine, phenobarbital, carbamazepine, levetiracetam) and 1 patient took steroid (prednisone). For many patients (76%), vitamin D supplementation was initiated according to the local protocol (100,000 IU of cholecalciferol every 15 days for 2 months) (Table 3). For 14 (9%) patients, no supplementation was introduced regardless of drug level (Table 3). For any patient, vitamin D blood control was performed.

Table 1: Characteristics of patients

Characteristic	Data
Age (years), mean ± SD (extrema)	83.9 ± 7.8 (65-100)
Sex, n (%)	
Women	95 (64%)
Men	54 (36%)
Weight, mean ± SD	67.2 ± 16.5 (36.3-136.0)
BMI, mean ± SD	25.5 ± 5.9 (14.2-53.8)
Admitting diagnosis, n (%)	
Home care difficult	35 (23.5%)
Fall	33 (22.1%)
General health impairment	19 (12.8%)
Infection (COVID, pneumonia, erysipelas, sepsis…)	12 (8.1%)
Other (asthenia, anemia, arthrosis…)	12 (8.1%)
Neurological condition (dementia, Parkinson, seizure)	10 (6.7%)
Cardiovascular injury (atrial fibrillation…)	9 (6.0%)
Pulmonary injury (COPD, dyspnea…)	8 (5.4%)
Fracture	4 (2.7%)
Metabolic injury (diabetes, hyperkalemia…)	4 (2.7%)
Malnutrition	3 (2.0%)
Presence of acute fracture, n (%)	
Yes	8 (5.4%)
No	141 (64.6%)
Treatment with antiepileptic, n (%)	
Yes	3 (2.0%)
No	146 (98.0%)
Treatment with systemic steroid	
Yes	1 (0.7%)
No	148 (99.3%)

Table 2: Correlation results between the selected variables and the vitamin D level.

Variable	Mean ± SD	Pearson coefficient	p-value
Age (years)	83.9 ± 7.8	0.0659	0.4244
Gender	95 (64%) Women	-2.4	**0.04**
	54 (36%) Men		
BMI (kg/m2)	25.5 ± 5.9	-0.0409	0.6262
Calcium (mmol/L)	2.31 ± 0.15	0.2669	**0.006982**
Phosphorus (mmol/L)	1.01 ± 0.26	-0.0349	0.795

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Table 3: Vitamin D supplementation according drug level.

Vitamin D level (µg/L)	Cholecalciferol supplementation prescription
<3.0, n=8	Local protocol* (n=6)
	No supplementation (n=2)
3-12, n=36	Local protocol (n=32)
	100,00 IU one day (n=2)
	100,000 IU every 30 days (n=1)
	No supplementation (n=1)
12-30, n=88	Local protocol (n=68)
	No supplementation (n=8)
	100,00 IU one day (n=5)
	100,000 IU every 3 months (n=4)
	100,00 IU two days (n=1)
	100,000 IU every 30 days (n=2)
>30, n=17	Local protocol (n=8)
	100,000 IU every 3 months (n=4)
	100,000 IU one day (n=1)
	100,000 IU two days (n=1)
	No supplementation (n=3)

*Local protocol=100,000 IU cholecalciferol every 15 days for 2 months

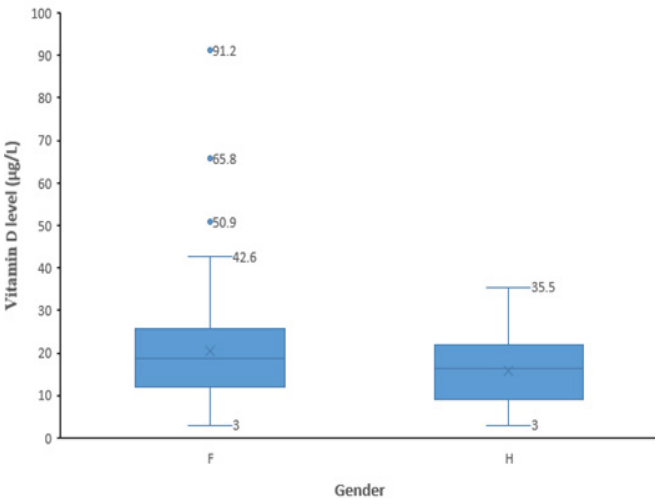

Figure 1: Graphical representation of mean vitamin D level by sex.

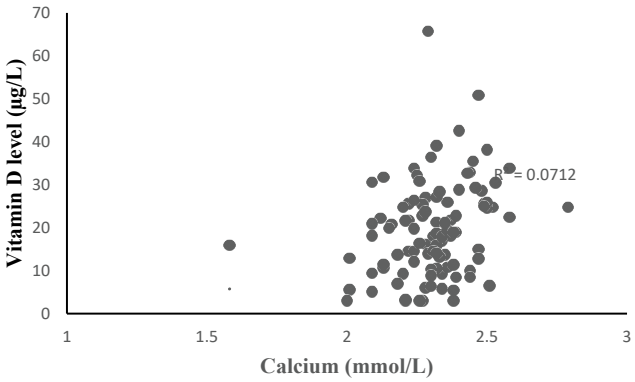

Figure 2: Relationship between calcium and vitamin D level

Discussion

The principal aim of this study was to determine the prevalence of vitamin D deficiency among older adults in a French geriatric hospital. Overall, 88.6% of patients had insufficient serum levels of vitamin D (<30 µg/L), and over 29.5% of participants had a severe vitamin D deficiency (<12 µg/L). Low vitamin D levels, especially among the elderly, has been shown to cause severely impaired muscle function by interfering with specific nuclear receptor in muscle and mineralization disorders such as osteopenia and osteomalacia [22, 27, 28]. Moreover, the dose-response of vitamin D level could be associated with higher risk of injurious falls in older population [29]. An American study including 4,100 older adults showed that low levels of vitamin D prolonged time to completion on the 8-foot walk test and the sit-to-stand test [30]. Sun exposure and optimization of the diet with few vitamin D-rich foods are the major ways to increase vitamin D level in seniors [31, 32]. However, older people in institution or in long-term care unit are deemed to have a higher risk of vitamin D deficiency due to low exposure to sunlight, a diet poor in vitamin D, or poly-pathological health status. In order to supplement a deficiency in vitamin D, cholecalciferol was routinely prescribed using a specific protocol (100,000 IU every 15 days during 2 months) in our hospital regardless of the blood levels of this drug. In this case, the vitamin D supplementation corresponded to a daily dose of 7000 IU according the recommendations for curative treatment of the available commercial drug (Uvedose 100,000 IU, Crinex, France). Currently, there is no French national consensus of the optimal level for vitamin D supplementation. Although the European Food Safety Authority advises a maximum of 4000 IU/day, many countries have adopted a conservative upper limit of 2000 IU/day for adults [23, 33]. The upper daily limit given by the Endocrine Society is 10,000 IU [8]. Vitamin D toxicity is rare and occurred for serum levels of 25(OH)D concentration often exceeded 150 µg/L. The characteristic signs of vitamin D toxicity are hypercalcemia and hypercaliuria [34]. In our study, any vitamin D serum

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level was prescribed to control efficacy or toxicity of the local protocol. Due to the high prevalence of vitamin D deficiency among older adults and the adoption of a supplementation protocol irrespective of the 25(OH)D serum level, strategies to identify patients at higher risk for vitamin D deficiency are challenging. The team of Deschasaux et al had developed simple scoring system based on easy-to assess individual characteristics to predict a vitamin D Insufficiency [35]. This score used information on individual characteristics of patients such as sex, BMI, physical activity, residential latitude, and usual sun exposure. This useful tool could be integrated in our clinical practice to obviate unnecessary supplementation and blood testing.

Conclusion

In conclusion, prevalence of vitamin D deficiency in the older adults hospitalized in our hospital was high with vitamin D serum level correlated with the calcium level of the patients. The supplementation of a dose of 7000 IU vitamin D3 per day during 2 months was routinely prescribed regardless the 25(OH)D serum level. To check efficacy of the supplementation, a blood test should be scheduled at the end of protocol.

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Data availability

All relevant data has been presented in the manuscript and further inquiry can be directed to the corresponding author.

Contributions

JS, decided study design and concept, drafted manuscript; DLL, revised manuscript. All authors have read and approve the final manuscript.

Ethics declarations

Ethics approval and consent to participate

The requirement for informed consent was waived by the Ethic Committee of the Paul Doumer Hospital because of the retrospective nature of the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

References

1. Hossein-nezhad A, Holick MF. Vitamin D for Health: A Global Perspective. Mayo Clin Proc 88 (2013): 720–755.
2. Marcos-Pérez D, Sánchez-Flores M, Proietti S, Bonassi S, Costa S, et al. Low Vitamin D Levels and Frailty Status in Older Adults: A Systematic Review and Meta-Analysis. Nutrients 12 (2020): 2286.
3. Remelli F, Vitali A, Zurlo A, Volpato S. Vitamin D Deficiency and Sarcopenia in Older Persons. Nutrients 11 (2019): 2861.
4. Benedik E. Sources of vitamin D for humans. Int J Vitam Nutr Res 92 (2022): 118-125.
5. EFSA. Scientific opinion on dietary reference values for vitamin D. EFSA (2016).
6. Institute of Medicine (US) Committee to Review Dietary Reference Intakes for Vitamin D and Calcium. . Ross AC, Taylor CL, Yaktine AL, Del Valle HB. Dietary Reference Intakes for Calcium and Vitamin D. National Academies Press (2011).
7. Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, et al. Endocrine Society Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab 96 (2011): 1911-1930.
8. Cashman KD, Fitzgerald AP, Kiely M, Seamans KM. A systematic review and meta-regression analysis of the vitamin D intake-serum 25-hydroxyvitamin D relationship to inform European recommendations. Br J Nutr. 106 (2011): 1638-1648.
9. Jodar E, Campusano C, de Jongh RT, Holick MF. Calcifediol: a review of its pharmacological characteristics and clinical use in correcting vitamin D deficiency. Eur J Nutr 62 (2023): 1579-1597.
10. Dawson HB, Mithal A, Bonjour JP. IOF position statement: vitamin D recommendations for older adults. Osteoporos Int 21 (2010): 1151–1154.
11. ANSES. National Agency for food, environmental and occupational health and safety (2021).
12. Avenell A, Smith TO, Curtain JP, Mak JC, Myint PK. Nutritional supplementation for hip fracture aftercare in older people. Cochrane Database Syst Rev 11 (2016):CD001880.
13. Girgis CM, Clifton-Bligh RJ, Hamrick MW, Holick MF, Gunton JE. The roles of vitamin D in skeletal muscle: form, function, and metabolism. Endocr Rev 34 (2013):33-83.
14. Mora JR, Iwata M, von Andrian UH. Vitamin effects on the immune system: vitamins A and D take centre stage. Nat Rev Immunol 8 (2008): 685-698.
15. Souberbielle JC, Body JJ, Lappe JM, Plebani M,

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DOI:10.26502/acbr.50170397

Shoenfeld Y, et al. Vitamin D and musculoskeletal health, cardiovascular disease, autoimmunity and cancer: Recommendations for clinical practice. Autoimmun Rev 9 (2010): 709-715.

16. Sommer I, Griebler U, Kien C, Auer S, Klerings I, et al. Vitamin D deficiency as a risk factor for dementia: a systematic review and meta-analysis. BMC Geriatr 17 (2017): 16.

17. Munger KL, Levin LI, Hollis BW, Howard NS, Ascherio A. Serum 25-hydroxyvitamin D levels and risk of multiple sclerosis. JAMA 296 (2006): 2832-2838.

18. Rasouli N, Brodsky IG, Chatterjee R, Kim SH, Pratley RE, et al. Effects of Vitamin D Supplementation on Insulin Sensitivity and Secretion in Prediabetes. J Clin Endocrinol 107 (2022): 230-240.

19. Pittas AG, Dawson-Hughes B. Vitamin D and diabetes. J Steroid Biochem Mol Biol 121 (2010): 425-429.

20. Abioye AI, Bromage S, Fawzi W. Effect of micronutrient supplements on influenza and other respiratory tract infections among adults: a systematic review and meta-analysis. BMJ Glob Health 6 (2021): e003176.

21. Yang J, Ou-Yang J, Huang J. Low serum vitamin D levels increase the mortality of cardiovascular disease in older adults: A dose-response meta-analysis of prospective studies. Medicine (Baltimore) 98 (2019): e16733.

22. Haitchi S, Moliterno P, Widhalm K. Prevalence of vitamin D deficiency in seniors - A retrospective study. Clin Nutr ESPEN 57 (2023): 691-696.

23. Amrein K, Scherkl M, Hoffmann M, Neuwersch-Sommeregger S, Köstenberger M, et al. Vitamin D deficiency 2.0: an update on the current status worldwide. Eur J Clin Nutr 74 (2020): 1498-1513.

24. Lips P, Cashman KD, Lamberg-Allardt C, Luisa Bianchi J, Stepan J, et al. Current vitamin D status in European and Middle East countries and strategies to prevent vitamin D deficiency: a position statement of the European Calcified Tissue Society. Eur J Endocrinol 180 (2019): P23-P54.

25. Vallejo MS, Blümel JE, Arteaga E, Aedo S, V Tapia, et al. Gender differences in the prevalence of vitamin D deficiency in a southern Latin American country: a pilot study. Climacteric 23 (2020): 410-416.

26. AlQuaiz AM, Kazi A, Fouda M, Alyousefi N. Age and gender differences in the prevalence and correlates of vitamin D deficiency. Arch Osteoporos 13 (2018): 49.

27. Glerup H, Mikkelsen K, Poulsen L, Hass L, S Overbeck, et al. Hypovitaminosis D myopathy without biochemical signs of osteomalacic bone involvement. Calcif Tissue Int 66 (2000): 419-424.

28. Bischoff HA, Borchers M, Gudat F, Duermueller U, R Theiler, et al. In situ detection of 1,25-dihydroxyvitamin D3 receptor in human skeletal muscle tissue. Histochem J 33 (2001): 19-24.

29. Bischoff-Ferrari HA, Dawson-Hughes B, Willett WC, Staehelin HB, Bazemore MG, et al. Effect of Vitamin D on falls: a meta-analysis. JAMA 291 (2004): 1999-2006.

30. Bischoff-Ferrari HA, Dietrich T, Orav EJ, Hu FB, Zhang Y, et al. Higher 25-hydroxyvitamin D concentrations are associated with better lower-extremity function in both active and inactive persons aged > or =60 y. Am J Clin Nutr 80 (2004): 752-758.

31. Okan F, Okan S, Zincir H. Effect of Sunlight Exposure on Vitamin D Status of Individuals Living in a Nursing Home and Their Own Homes. J Clin Densitom 23 (2020): 21-28.

32. Schmid A, Walther B. Natural vitamin D content in animal products. Adv Nutr 4 (2013): 453-462.

33. EFSA Panel on Nutrition, Novel Foods and Food Allergens (NDA), Turck D, Bohn T, et al. Scientific opinion on the tolerable upper intake level for vitamin D, including the derivation of a conversion factor for calcidiol monohydrate. EFSA J 21 (2023): e08145.

34. Fraser DR. Vitamin D toxicity related to its physiological and unphysiological supply. Trends Endocrinol Metab 32 (2021): 929-940.

35. Deschasaux M, Souberbielle JC, Andreeva VA, Sutton A, Charnaux N, et al. Quick and Easy Screening for Vitamin D Insufficiency in Adults: A Scoring System to Be Implemented in Daily Clinical Practice. Medicine (Baltimore) 95 (2016): e2783.