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Assessment of the quality and content of clinical practice guidelines for vitamin D and for immigrants using the AGREE II instrument: global systematic review

Said Yousef ,[1,2] Lamia Hayawi ,[3] Alomgir Hossain ,[4,5] Nazmun Nahar ,[5] Doug Manuel ,[6] Ian Colman ,[1] Emmanuel Papadimitropoulos ,[7,8] MoezAlIslam E Faris ,[9] Leenah Abdelrazeq ,[10] George A Wells [1,11]

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For numbered affiliations see end of article.

Correspondence to
Dr Said Yousef;
sabde029@uottawa.ca

ABSTRACT

Background Worldwide, more immigrants experience vitamin D (vitD) deficiency than non-immigrants. Recommendations in current clinical practice guidelines (CPGs) concerning vitD are inadequate to address vitD deficiency among immigrants, and there are concerns regarding the quality of guidance in these CPGs.

Objectives This study aimed to identify and evaluate the quality of published CPGs addressing vitD and immigrants' health using the Appraisal of Guidelines for Research and Evaluation-II (AGREE II) tool and clarify the recommendations pertaining to vitD and immigrant populations in these CPGs.

Methods We performed a systematic search to identify the most recent CPGs across various databases (Ovid MEDLINE ALL, Embase and Turning Research Into Practice), guideline repositories and grey literature. Two reviewers independently conducted study selection and data abstraction and evaluated the quality of the included guidelines using the AGREE II tool.

Results We identified 25 relevant CPGs; 21 focused on vitD and 4 covered immigrants' health. Around one-quarter of the included CPGs were high quality (≥60% in at least four of the six domains, including 'rigour of development'). The highest mean scores among the six AGREE II domains were for 'clarity of presentation' and 'scope and purpose'. About 4.8% (1/21) of the CPGs on vitD had immigrant-related recommendations. VitD recommendations were emphasised in one out of the four immigrant health CPGs (25%). CPGs covering immigrants' health and vitD were inadequately systematically appraised. Moreover, recommendations regarding vitD were insufficient to address the growing epidemic of vitD deficiency among immigrant populations.

Conclusion The insufficient recommendations for vitD fail to address the rising vitD deficiency among immigrants, highlighting a critical gap in healthcare provisions. Urgent national and international efforts are needed to develop comprehensive CPGs, bridging research, policy and practice disparities. Future guidelines must prioritise routine vitD screening, supplementation protocols for vulnerable immigrant groups, and culturally appropriate interventions to improve health outcomes for immigrants globally.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ A systematic search was conducted to identify the most recent clinical practice guidelines (CPGs) across multiple electronic databases.
⇒ The study employs the validated Appraisal of Guidelines for Research and Evaluation-II instrument to comprehensively assess the quality of CPGs, including whether the guideline is recommended for use, enhancing the credibility and applicability of the study findings.
⇒ We used the IOM definition of CPGs as statements with recommendations to optimise patient care, informed by systematic evidence review and assessment of the benefits and harms of alternative care options.
⇒ The study evaluates the availability of recommendations pertaining to vitamin D and immigrant populations in the related-included CPGs.
⇒ Only English-published CPGs were included, potentially introducing selection bias, and the intended categorisation by immigration status and region was not possible due to the limited reported data.

INTRODUCTION

The rapid growth in the number of international immigrants and the global problems of vitamin D (vitD) deficiency and health deterioration among immigrants over time are expected to lead to significant burdens for the health systems of host countries.[1 2] Recent migrants often have better health compared with both the host country's population and earlier migrants. This 'healthy immigrant effect' is thought to arise from premigration and postmigration factors, including selective

immigration criteria favouring healthier, wealthier and better-educated individuals.[3 4] Health deterioration among immigrants is a global concern[5–8]; their physical and mental health often declines quickly following arrival in their host countries,[6 9–11] and further health changes occur over 5–10 years.[6 12 13] Mechanisms underlying this health decline in immigrants have not been explicitly identified,[6 9] but previous studies suggested that it may be explained by changes in psychosocial factors and lifestyles after immigration.[4 9 10 14 15]

Globally, immigrants have lower serum 25-hydroxyvitamin D (S-25(OH)D) levels compared with native-born populations.[16–18] It was recently suggested that lower levels of serum vitD may partly explain immigrants' health deterioration over time.[1] An analysis of national Canadian data for immigrants from 153 countries and more than 13 ethnicities reported ethnicity was strongly associated with serum vitD status.[18] Non-Western immigrants were also identified by the European Calcified Tissue Society as a specific group at higher risk for vitD deficiency that should receive vitD supplementation.[19] Moreover, vitD status varies among immigrants based on skin pigmentation, clothing type, place/region of birth and resettlement changes in diet, physical activity and sun exposure.[16 20 21]

Clinical practice guidelines (CPGs) are based on scientific evidence and provide up-to-date knowledge, speed the translation of research into practice, improve the effectiveness and quality of care, and decrease variations in healthcare practices.[22–24] Currently, CPGs pertaining to vitD vary among countries and organisations in terms of their scope, targeted populations and recommendations.[25–28] The immigrant-related guidelines focused on screening, infectious diseases, mental health, chronic diseases, treatment and immunisation.[13 29 30] Notably, some of these publications lacked systematic quality appraisal,[29] vitD recommendations for addressing vitD deficiency in immigrant populations[27 31] and neglecting high-risk ethnic groups.[25 27 32–34] The 2011 Canadian Immigrant and Refugee Guideline acknowledged the decline in the 'healthy immigrant effect' within the first 5 years of immigration but failed to highlight vitD deficiency as an emerging concern.[13]

Concerns have also been raised about the overall quality of available CPGs.[29 35 36] The Appraisal of Guidelines for Research and Evaluation-II (AGREE II) instrument is widely used to assess guideline quality and define information that needs to be reported and is considered a useful tool to inform guideline development.[37 38] AGREE II assessment covers the quality of the guideline and whether or not the guideline would be recommended for use.[38] However, previous studies that assessed the quality of CPGs using the AGREE II instrument were inconsistent in how they determined high quality. For example, with the inclusion of the 'rigour of development' domain, a high-quality score was reported as ≥60% in at least three of the six domains,[29] four of the six domains[39] or in all six domains.[40] Therefore, to overcome gaps in knowledge concerning vitD and immigrants' health, this systematic review aims to identify CPGs relevant to vitD and immigrants' health and systematically evaluate the quality and the content of the guidelines. In terms of content, the study sought to answer two research questions: (1) 'Do CPGs for immigrants' health include recommendations on vitD?' and (2) 'Do CPGs for vitD include recommendations for immigrants?'

METHODS

The protocol for this systematic review was registered with PROSPERO (CRD42021240562)[41] and published.[42] We followed the Cochrane methodology[43] to identify and select CPGs and used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to guide the reporting.[44]

Search strategy and selection of CPGs

A systematic literature search was performed to identify CPGs on vitD and immigrants/refugees worldwide. The primary search was completed in Ovid MEDLINE(R) ALL. The final search strategy was then translated to Embase Classic+Embase (Ovid), as well as the Turning Research Into Practice database. To identify relevant grey literature, we searched well-known guideline developers, such as the Guidelines International Network, Joanna Briggs Institute, WHO, Healthcare Research and Quality and the National Institute for Health and Care Excellence (NICE). Supplemental searches were performed using backward chaining (looking through the bibliographies in identified guidelines for additional relevant guidelines). The Canadian Agency for Drugs and Technologies in Health filter for searching keywords in guidelines was used.[45 46] The search was restricted to guidelines published between 2010 and 2024 and studies involving humans. The full search strategy was developed with the help of a medical librarian at Berkman Library, University of Ottawa Heart Institute. The Ovid MEDLINE search strategy is available in online supplemental file 1.

Eligibility criteria

We included guidelines that conformed to the IOM definition of CPGs 'statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options'[22] and concerned immigrants' health or vitD. The full-text guidelines included in our analysis must have been published in the English language between 2010 and 2024, with recommendations intended for healthcare professionals on screening, diagnosis, management or treatment related to immigrants' health or vitD. Any CPG concerning vitD that emphasised care for people at risk for vitD deficiency in terms of evaluation, treatment and prevention was also evaluated, without age and sex restrictions. CPGs that included immigrants as a primary population were evaluated without age and sex restrictions.

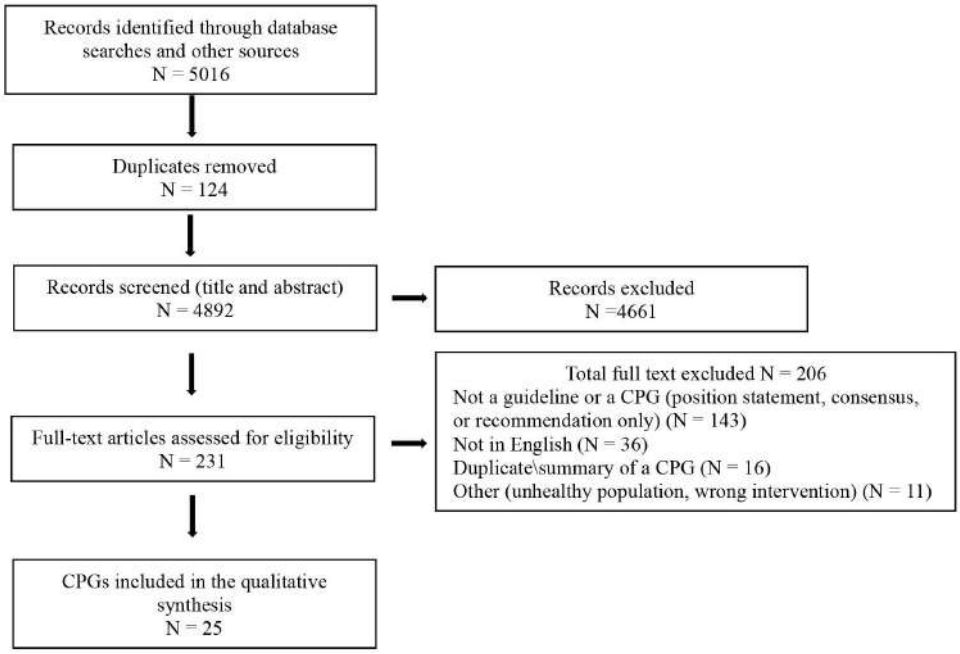

Figure 1 Literature search and inclusion flow chart (Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram). CPGs, clinical practice guidelines.

The immigrant population (including refugees and asylum seekers) was defined as those who moved cross-country or were international migrants residing in a destination country, irrespective of legal status and not limited to first-generation immigrants.[47 48]

Exclusion criteria

We excluded CPGs that focused on chronic diseases, were non-English language, had incomplete text guidelines and did not consider immigrants or vitD as the primary objective. We also excluded guidelines that were not intended for healthcare practice or focused on unhealthy populations (eg, patients with osteoporosis). Evaluating evidence in nutritional guidelines is beyond the scope of this review. Furthermore, we excluded position and consensus papers as well as any other documents that were not equivalent to CPGs.

Outcomes

The primary outcome of this review was the quality score of the included CPGs based on the AGREE II tool. The secondary outcomes were recommendations relating to vitD as part of immigrant guidelines and recommendations in vitD guidelines that targeted immigrant populations.

Selection of CPGs and data extraction

We used the 'Covidence' (www.covidence.org) systematic review software to remove duplicates, screen the titles and abstracts and screen the full text of the identified CPGs. The AGREE II instrument (https://www.agreetrust.org) was used to evaluate the quality of the included guidelines. This tool comprises 23 items and evaluates six domains: 'scope and purpose', 'stakeholder involvement', 'rigour of development', 'clarity of presentation', 'applicability', and 'editorial independence'.[38] Using an online electronic standardised form, two reviewers (SY and LH) independently evaluated and rated each CPG using a seven-point Likert scale (1=strongly disagree, 7=strongly agree).[38] The items scoring sheet of AGREE II tool is presented in (online supplemental file 2). Furthermore, the reviewers evaluated the content of each CPG and any additional supporting documents that were cited in the published guidelines. Any disagreements regarding assessment were resolved by discussion with a third reviewer to reach consensus. Two reviewers (SY and LH) extracted the main characteristics of the included CPGs, and the extracted data were checked by a third reviewer (NN or LA).

Quality evaluation and data synthesis

The reviewers' decisions on the overall quality of recommendations contained in the guidelines were based on the context in which the AGREE II was being used. We used the mean scores for each AGREE II domain to calculate total domain scores by summing scores for individual items in a domain. The total domain score was then scaled as a percentage of the maximum possible score for that domain. The formula used to standardise the domain scores was ((actual score − minimum score)/(maximum score − minimum score)) × 100%. The range of each standardised domain score was 0%–100%.[49] The maximum possible score was obtained by multiplying the maximum score for each domain (strongly agree) by the number of items in the domain and the number of reviewers. Similarly, the minimum possible score was obtained by multiplying the minimum score for each domain (strongly disagree) by the number of items in the domain and the number of reviewers.[49] CPGs were considered high

Table 1 Characteristics of the VitD-related CPGs (n=21) and immigrants-related CPGs (n=4)

ID	Author, year	Title	Organisation (country/region)	CPG scope	Recommendation
	VitD-related CPGs (n=21)				**Recommendations for immigrants**
1	Marcinowska-Suchowierska *et al*, 2010)[56]	Vitamin D supplementation in adults—guideline	Poland	VitD supplementation in adults	NR
2	Holick *et al*, 2011[70]	Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society Clinical Practice Guideline	Endocrine Society, US	Evaluation, treatment, and prevention of vitD deficiency	NR
3	WHO, 2012[55]	Vitamin D supplementation in pregnant women	WHO, Switzerland	VitD supplementation during pregnancy	NR
4	Pludowski *et al*, 2013[57]	Practical guidelines for the supplementation of vitamin D and the treatment of deficits in Central Europe	Central Europe	VitD intake in the general population and groups at risk for vitD deficiency	NR
5	USPSTF, 2013[58]	Vitamin D and calcium supplementation to prevent fractures in adults: USPSTF Recommendation Statement	USPSTF, US	VitD and calcium supplementation to prevent fractures in adults	NR
6	NOS, 2013[59]	Vitamin D and bone health: A practical clinical guideline for patient management	NOS, UK	Management of vitD deficiency in adults	NR
7	Alberta Medical Association, 2014[60]	Vitamin D testing and supplementation	Alberta Medical Association, Canada	VitD testing and supplementation	NR
8	Maeda *et al*, 2014[61]	Recommendations of the Brazilian Society of Endocrinology and Metabology for the diagnosis and treatment of hypovitaminosis D	SBEM, Brazil	Diagnosis and treatment of hypovitaminosis D	NR
9	NICE, 2014[26]	Vitamin D: supplement use in specific population groups	NICE, UK	Prevent vitD deficiency among specific population groups	NR
10	SA Health Perinatal Practice, 2016[62]	Vitamin D status in pregnancy	SA MNGCoP, Australia	VitD management for women and their newborns	VitD screening for “newly arrived refugees”, details in online supplemental file 3
11	Khadilkar *et al*, 2017[63]	Prevention and treatment of vitamin D and calcium deficiency in children and adolescents: IAP	IAP, India	Prevention and treatment of vitD and calcium deficiency in the Indian context	NR
12	ROS, 2018[64]	Vitamin D and bone health: A practical clinical guideline for patient management	ROS, UK	VitD patient management	NR
13	Haq *et al*, 2018[65]	Clinical practice guidelines for vitamin D in the United Arab Emirates	United Arab Emirates	Overcome the high incidence of vitD deficiency and to improve overall health	NR

Continued

Table 1 Continued

ID	Author, year	Title	Organisation (country/region)	CPG scope	Recommendation
14	SA Paediatric Clinical Practice Guidelines, 2018[66]	vitamin D deficiency in children	SA Child & Adolescent Health Community of Practice, Australia	Assessment (including investigations) and management of vitD deficiency	NR
15	USPSTF, 2018[32]	Vitamin D, calcium, or combined supplementation for the primary prevention of fractures in community-dwelling adults	USPSTF, US	VitD supplementation, with or without calcium, to prevent fractures	NR
16	BC Guidelines, 2019[33]	Vitamin D testing	Medical Services Commission, BC, Canada	VitD testing in the general population in BC	NR
17	WHO, 2020[34]	WHO antenatal care recommendations for a positive pregnancy experience Nutritional interventions update: Vitamin D supplements during pregnancy	WHO, Geneva, Switzerland	VitD supplements during pregnancy	NR
18	USPSTF, 2021[67]	Screening for Vitamin D Deficiency in Adults: USPSTF Recommendation Statement	USPSTF, US	Screening and early treatment including the benefits and harms	NR
19	Casado 2021[68]	SEIOMM recommendations on the prevention and treatment of vitamin D deficiency	SEIOMM, Spain	Preventing and treating vitamin D deficiency	NR
20	Gupta *et al*, 2021[69]	Indian Academy of Pediatrics Revised (2021) Guidelines on Prevention and Treatment of Vitamin D Deficiency and Rickets	IAP, India	The role of vitD supplementation during infancy and childhood	NR
21	Pludowski *et al*, 2023[54]	Guidelines for Preventing and Treating Vitamin D Deficiency: A 2023 Update in Poland	PSPED, Poland	Prevention, diagnosis, and treatment of vitD deficiency	NR
	Immigrant-related CPGs (n=4)				**Recommendations for VitD**
1	Pottie *et al*, 2011[13]	Evidence-based clinical guidelines for immigrants and refugees	CCIRH, Canada	Clinical preventive recommendations for immigrants and refugees	NR, (the topic of vitD deficiency was unrecognised and reported by the panel as a limitation of this CPG)
2	Chaves *et al*, 2016[71]	Recommendations for comprehensive post-arrival health assessment for people from refugee-like backgrounds	ASID and RHeaNA, Australia	Health assessment for newly arrived people (refugees)	Check vitD, risk factor for low vitD, treat low vitD and ensure adequate calcium intake, sun exposure and self-management, details in online supplemental file 3
3	Tosti *et al*, 2021[72]	Health assessment for migrants and asylum seekers on arrival and while hosted in reception centres	National Institute for Health, Migration and Poverty, Italy	Health assessments for migrants and asylum seekers on their arrival	NR

Continued

Table 1 Continued

	Immigrant-related CPGs (n=4)				Recommendations for VitD
4	Vignier *et al*, 2022[73]	Public health issues and health rendezvous for migrants from conflict zones in Ukraine: A French practice guideline	HCSP, France	Medical examination of migrants and health situation of people leaving conflict zones in Ukraine	NR

ASID and RheaNA, Australasian Society for Infectious Diseases and Refugee Health Network; BC, British Columbia; CCIRH, Canadian Collaboration for Immigrant and Refugee Health; CPG, clinical practice guideline; HCSP, High Council for Public Health; IAP, Indian Academy of Pediatrics; MNGCoP, Maternal, Neonatal & Gynaecology Community of Practice; NA, not applicable; NICE, National Institute of Health and Care Excellence; NOS, National Osteoporosis Society; NR, no recommendations; PSPED, Polish Society of Pediatric Endocrinology and Diabetes; ROS, Royal Osteoporosis Society; SA, South Australian; SBEM, Brazilian Society of Endocrinology and Metabology; SEIOMM, Spanish Society for Bone Research and Mineral Metabolism; USPSTF, U.S. Preventive Services Task Force; VitD, vitamin D.

quality when the score was ≥60% in at least four of the six domains, including the 'rigour of development' domain.[39 50–52] Agreement between the two reviewers was assessed for the 23 items using two-way, random, single unit, absolute agreement intraclass correlation coefficients (ICC).[53] Based on previous research, we classified an ICC of <0.40 as poor or fair, 0.40–0.60 as moderate, 0.61–0.80 as good and 0.81–1.00 as excellent.[50] The availability of recommendations for vitD in immigrant guidelines and the inclusion of 'immigrant populations' in vitD guidelines were reported descriptively.

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

RESULTS

The PRISMA flow diagram (figure 1) shows the systematic process we followed to include studies captured by the electronic search. In total, 5016 citations were returned by our search. After removing duplicates and screening titles and abstracts, 231 articles were identified for full-text review. We excluded 206 articles after the full-text review because they were not a guideline or a CPG (ie, position statement, consensus or recommendation only), not in English, duplicate records, summary of a CPG, or other reasons (eg, unhealthy population or wrong intervention).

We identified 25 records as CPGs; 21 addressed vitD[26 32–34 54–70] and 4 focused on immigrants' health.[13 71–73] Eleven CPGs were from Europe,[26 34 54–57 59 64 68 72 73] seven were from North America,[13 32 33 58 60 67 70] three were from Australia,[62 66 71] three were from Asia[63 65 69] and one was from South America.[61] The majority of CPGs (22/25; 92%) were developed by official organisations such as academic institutions, governments, health associations or guideline development organisations. The remaining three guidelines were developed by non-official organisations such as researchers, university faculty members and a conference scientific committee.[56 57 65] Five of the included CPGs were described as updates of previously published guidelines.[54 60 64 66 67] To ensure comprehensive coverage and accuracy, both the updated guidelines and their original versions were reviewed in terms of content to confirm that all recommendations were systematically assessed.

Risk factors for vitD deficiency were identified in most of the 21 CPGs focused on vitD. The most commonly reported risk factors were darker skin (especially Africans); non-Caucasian race; obesity; limited sunlight exposure (including concealing clothing); people with kidney, liver, and inflammatory bowel diseases; pregnant and lactating women; older people; and vegetarians (especially vegans). Recommendations on vitD for newly arrived refugees were only considered in one guideline.[62] This guideline emphasised the importance of vitD screening at the first appointment for darker-skinned women (eg, Aboriginal, North African, Indian and Sri Lankan women) and newly arrived refugees. The guideline-related recommendations are presented in online supplemental file 3.

One of the four immigrants' health CPGs[71] recommended checking 'vitamin D status as part of the initial health assessment if there are one or more risk factors for low vitamin D'. Moreover, that guideline recommended 'treating people with low vitamin D to restore their levels to the normal range with either daily dosing or high dose therapy, ensuring adequate calcium intake, paired with advice about sun exposure and self-management'. Screening and treating people with ongoing risk factors may require ongoing monitoring and management throughout the person's lifespan. That guideline also recommended testing S-25(OH)D levels among recent arrivals and repeating this testing at the end of the first winter in the host country (Australia) to help in making clinical judgments on the frequency of dosing.[71] Moreover, the guideline outlines specific dosage recommendations based on the severity of vitD deficiency and age groups, ensuring appropriate supplementation. The detailed guideline-related recommendations are presented in table 1 and online supplemental file 3. In

Table 2 AGREE II total score (%) for each domain of the included CPGs

ID	Author, year	Scope and purpose	Stakeholder involvement	Rigour of development	Clarity of presentation	Applicability	Editorial independence
VitD-related CPGs (n=21)							
1	Marcinowska-Suchowierska *et al*, 2010[56]	0	3	0	28	0	0
2	Holick *et al*, 2011[70]	56	58	73	83	52	79
3	WHO, 2012[55]	100	89	100	100	75	100
4	Pludowski *et al*, 2013[57]	42	56	8	53	4	0
5	USPSTF, 2013[58]	81	58	50	67	35	71
6	NOS, 2013[59]	56	42	44	64	25	50
7	Alberta Medical Association, 2014[60]	67	67	40	83	33	79
8	Maeda *et al*, 2014[61]	58	44	52	83	31	50
9	NICE, 2014[26]	92	92	75	94	90	71
10	SA Health Perinatal Practice, 2016[62]	64	39	10	56	15	0
11	Khadilkar *et al*, 2017[63]	58	53	19	50	12	71
12	ROS, 2018[64]	36	25	31	75	19	58
13	Haq *et al*, 2018[65]	47	33	17	61	40	0
14	SA Paediatric Clinical Practice Guidelines, 2018[66]	22	36	6	39	10	0
15	USPSTF, 2018[32]	67	67	62	64	50	83
16	BC Guidelines, 2019[33]	67	67	44	64	58	50
17	WHO, 2020[34]	94	86	94	97	81	96
18	USPSTF, 2021[67]	97	69	73	92	40	100
19	Casado 2021[68]	64	39	67	75	21	12
20	Gupta *et al*, 2021[69]	61	58	48	69	38	71
21	Pludowski *et al*, 2023[54]	53	44	23	78	21	92
Immigrant-related CPGs (n=4)							
1	Pottie *et al*, 2011[13]	72	86	79	92	88	100
2	Chaves *et al*, 2016[71]	72	94	48	86	62	79
3	Tosti *et al*, 2021[72]	94	97	85	97	77	96
4	Vignier *et al*, 2022[73]	39	31	12	36	21	67

BC, British Columbia; CPGs, clinical practice guidelines; NICE, National Institute of Health and Care Excellence; NOS, National Osteoporosis Society; ROS, Royal Osteoporosis Society; SA, South Australian; USPSTF, U.S. Preventive Services Task Force; vitD, vitamin D.

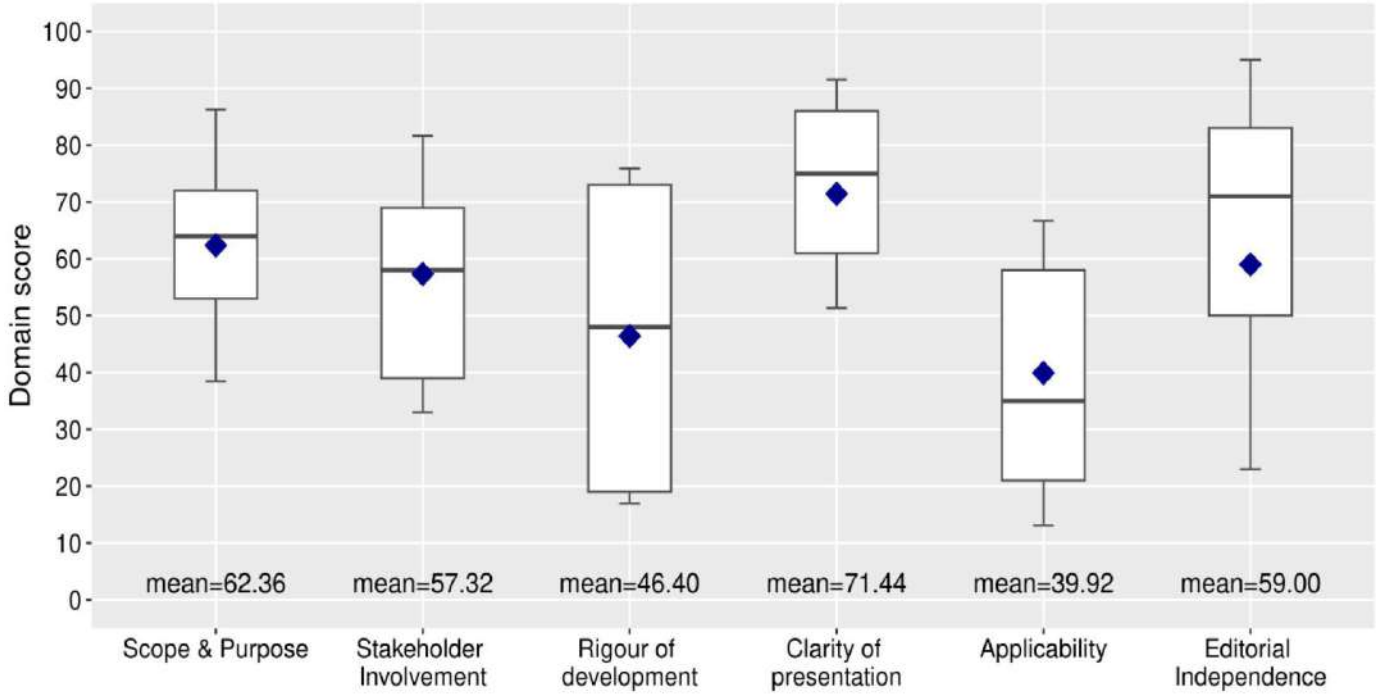

Figure 2 Overall Appraisal of Guidelines for Research and Evaluation-II scores for each domain.

another guideline, the expert panel responsible for developing the guideline initially failed to acknowledge vitD deficiency among immigrants. Subsequently, the panel identified this issue as an emerging health concern and reported it as a limitation of their CPG.[13]

In terms of quality, we found that nearly one-quarter of the included CPGs (7/25, 28%) were scored as high quality (≥60% in at least four of the six domains, including 'rigour of development').[13 26 32 34 55 67 72] The three highest total AGREE II domain scores were for the two CPGs developed by the national institute for health, migration and poverty, Italy[72] and an international organisation (WHO)[34 55] (table 2).

The overall ICC consistency between the AGREE II appraisers was good, with a mean (range) of 62% (47%–90%). Table 1 and online supplemental file 4 presents the ICC results. The mean (SD) scores for the six AGREE II domains were 62.4% (23.9%) for scope and purpose, 57.3% (24.3%) for stakeholder involvement, 46.4% (28.8%) for rigour of development, 71.4% (20.1%) for clarity of presentation, 39.9% (26.8%) for applicability and 59.0% (36.0%) for editorial independence (figure 2).

DISCUSSION

Although vitD deficiency among immigrants is a global issue that was detected more than five decades ago,[13 16 17 29 74 75] available vitD CPGs were country specific and varied in their recommendations. Moreover, few of these publications met the criteria for guideline development, as not all were defined as CPGs, and only one considered the immigrant population in the recommendations.[62] The scope of most of the vitD's CPGs focused on management and supplementation, none of them explicitly mentioned treatment or supplementation recommendations tailored to immigrant populations. One of the four immigrants' health CPGs focused on immigrants' health covered vitD testing and treatment.[71] The included CPG outlines specific dosage recommendations based on the severity of vitD deficiency and age groups, ensuring appropriate supplementation as shown in online supplemental file 3. The topic of vitD deficiency was highlighted as a limitation in another immigrant's CPG.[13]

Our analysis showed that CPGs for vitD and those for immigrants' health tended to be relatively poor in terms of acknowledging the growing vitD deficiency among vulnerable immigrant populations, both in general and in specific groups (eg, refugees and certain ethnicities/origins). A recent publication focused on Canadian immigrants found that ethnicity was strongly associated with S-25(OH)D levels,[2] with the highest deficiency levels among immigrants who were born in Morocco (55.9%), India (34.4%) and Lebanon (about 30%) compared with native-born Canadians (7.45%). Moreover, compared with the white ethnic grouping, the Japanese had the highest level of vitD deficiency, followed by Arabs and Southeast Asians.[18]

Based on AGREE II scores, nearly one-quarter of the included CPGs were evaluated as high quality. The quality of CPGs was associated with the developer (eg, well-known international organisations), with the three highest quality CPGs being those from the WHO (2012),[55] WHO (2020)[34] and the national institute for health, migration, and poverty, Italy (2021).[74] The quality of the included CPGs was not associated with the publication year (result not shown), which was consistent with some

of the previous systematic reviews,[39 76] but contrasted with others.[29 40 50] Consistent with previous studies,[29 39 77] the mean scores for the 'clarity of presentation' and 'scope and purpose' domains in our study were better than those for the other domains. We believe that including 'rigour of development' as an important domain for quality assessment offered a more meaningful quality evaluation method. The mean quality score for the rigour of development domain in this study was low (46.4%), although there were large variations in this domain among the included CPGs (eg, SD 29.5%). This domain was highest in the two WHO CPGs (2012 and 2020).[34 55]

In addition to the incorrect identification of some guidelines as CPGs and the low-quality of available CPGs that were not fully being used in practice, our study highlighted an urgent need for both national and international CPGs that address the growing problem of vitD deficiency among immigrants. Only one of the 21 CPGs focused on vitD[62] considered immigrants (newly arrived refugees) as being at risk for low vitD and recommended vitD screening at the first appointment, although most CPGs identified and highlighted darker skin as a risk factor.

A recent national cross-sectional population-based analysis in Canada evaluated the relationship between melanin levels (skin pigmentation) and S-25(OH)D among immigrants based on their ethnicity and region/country of birth compared with non-immigrants.[78] That study revealed that melanin had a weak positive correlation with S-25(OH)D levels that may be attributable to different confounding and inherited factors related to certain ethnicities, despite the level of skin pigmentation.[78]

In addition, a previous study highlighted the need for a global guideline that specifies subimmigrant populations for which the evidence and recommendations may differ from the overall immigrant population.[79] Therefore, it is necessary to develop CPGs based on the latest available evidence. CPGs bridge the gaps between research, policy and practice and support vitD screening and supplementation for vulnerable immigrant populations, including those from certain ethnicities/origins or groups at particular risk. It is also important that such guidelines also reflect culturally appropriate interventions that consider people of different religious faiths.

Strengths and limitations of this study

The present systematic review focused on guidelines that were defined as CPGs and intended to improve the effectiveness and quality of care and decrease variations in healthcare practices among the targeted populations based on scientific evidence. This study reduced the knowledge gap by exploring an area that has not been investigated in previous systematic reviews pertaining to this topic. As translating CPGs from other languages was a concern in this study, we only included CPGs that were published in English and excluded those for which the full text was found in other languages, which might have introduced selection bias.

In our protocol for this systematic review,[42] we planned to categorise available information based on immigration status (general immigrants, refugees and asylum seekers), ethnicity, region/country of birth, host country and other factors (eg, type of interventions) depending on their availability in the included guidelines. However, we were unable to specify or categorise information by immigrant subgroups, country or intervention type because of the limited information regarding vitD; that is, relevant recommendations in only one immigrant's health CPG[71] and one vitD CPG.[62]

Conclusion

We found the identified CPGs for immigrants' health and vitD were inadequately systematically appraised in terms of quality. Moreover, the current available recommendations for vitD were insufficient to address the growing epidemic of vitD deficiency among immigrant populations. Therefore, we support previous recommendations regarding the need for national and international CPGs that respond to the growing problem of vitD deficiency among immigrants. Gathering evidence regarding vitD screening and supplementation for specific vulnerable immigrant population groups (eg, those from different ethnicities or origins) will support the development of CPGs that can bridge the gaps between research, policy and practice. It is also important that such guidelines recommend interventions that are appropriate for different faiths and cultures.

Author affiliations
[1]School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario, Canada
[2]University of Ottawa Heart Institute Cardiovascular Devices Research Laboratory, Ottawa, Ontario, Canada
[3]Children's Hospital of Eastern Ontario, Ottawa, Ontario, Canada
[4]The Hospital for Sick Children, Toronto, Ontario, Canada
[5]University of Ottawa Heart Institute, Ottawa, Ontario, Canada
[6]Clinical Epidemiology Program, Ottawa Hospital Research Institute, Ottawa, Ontario, Canada
[7]Eli Lilly Canada, Toronto, Ontario, Canada
[8]University of Toronto Leslie Dan Faculty of Pharmacy, Toronto, Ontario, Canada
[9]Department of Clinical Nutrition and Dietetics, Faculty of Allied Medical Sciences, Applied Sciences Private University, Amman, Jordan
[10]Health Sciences, Carleton University, Ottawa, Ontario, Canada
[11]Cardiovascular Research Methods Centre, University of Ottawa Heart Institute, Ottawa, Ontario, Canada

X Said Yousef @NA

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ORCID iDs
Said Yousef http://orcid.org/0000-0002-4968-6918
Lamia Hayawi http://orcid.org/0000-0002-0153-5926
Alomgir Hossain http://orcid.org/0000-0002-7614-0072
Nazmun Nahar http://orcid.org/0009-0000-5685-3318
Doug Manuel http://orcid.org/0000-0003-0912-0845
Ian Colman http://orcid.org/0000-0001-5924-0277
Emmanuel Papadimitropoulos http://orcid.org/0000-0002-3688-523X
MoezAllslam E Faris http://orcid.org/0000-0002-7970-2616
Leenah Abdelrazeq http://orcid.org/0009-0009-3005-306X
George A Wells http://orcid.org/0000-0002-2289-9139

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