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The Global Calcium Dashboard: Country-Specific Data on Calcium Intakes, Policies, and Related Health Outcomes

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ABSTRACT

Low calcium intake is a widespread global health problem that impacts maternal health, neonatal survival, and the development of chronic health problems such as osteoporosis. Despite its important health implications, fragmented data on calcium intakes and related health outcomes have hindered more strategic responses. We aimed to develop a centralized, interactive platform that visualizes calcium intakes, associated health outcomes, and policies across countries. The Global Calcium Dashboard integrates datasets that include calcium intake estimates, as well as calcium supplementation guidelines, food-based recommendations, and fortification legislation. Epidemiological data and modeled estimates on preterm births, maternal hypertensive disorders, and bone fractures were also incorporated to highlight areas with the greatest potential need for improved calcium intake. Country typologies were created based on the risk of adverse health outcomes and the presence of policies or guidelines for calcium interventions. Countries with the greatest risk of adverse health outcomes and lacking calcium intervention policies were primarily found in sub-Saharan Africa and parts of South Asia. Supporting these countries in developing calcium-based interventions to address this nutrient gap has the greatest likelihood to improve health outcomes, especially for mothers and their infants.

1 | Introduction

Calcium is an essential micronutrient required to maintain bone health and cellular functions, such as muscle contraction and signaling [1]. Despite its vital functions, it is estimated that more than half the world's population does not consume enough calcium—90% of whom live in low- and middle-income countries (LMICs) in Africa and Asia [1]. Average requirements for calcium range from 625 to 1100 mg/day for adolescents and between 525 and 1000 mg/day for adults (excluding lactation) [2], yet average intakes in many LMICs are below 500 mg/day [3].

While calcium is important for several aspects of health [1], the adverse effects of low calcium diets during pregnancy are especially concerning because they are linked to an increased risk of preeclampsia and preterm birth (PTB) [4]. As a result, for the prevention of preeclampsia and its complications, the World Health Organization (WHO) recommends supplementation with 1.5–2 g/day of elemental calcium during pregnancy and to improve calcium intake before and during pregnancy in areas where calcium intake is low [5–7].

There is no population-based biomarker of calcium status, making it especially difficult to identify populations at risk of calcium deficiency [8]. Instead, estimation of the prevalence of inadequate calcium intake is the best method to approximate calcium status within a population, but the required data are often scarce and not nationally representative [9]. Similarly, representative data on maternal hypertensive disorders (MHDs) and PTB are often unavailable. To fill in the data gaps, several modeling efforts have aimed to estimate calcium intake and related health outcomes.

The primary and modeled data come from disparate sources and, to our knowledge, have not been compiled in one place.

The Nutrition Science Program of New York Academy of Sciences created the Global Calcium Dashboard to bring together the primary and modeled global data related to calcium. The dashboard's aim is to inform future research, highlight information gaps, and support advocacy efforts and policy decisions in areas where calcium interventions may have the greatest potential to benefit populations, with a focus on maternal and infant health outcomes. In this paper, we describe the data used to create the dashboard, as well as the development of country typologies to classify countries based on health risks and policy environments.

2 | Methods

2.1 | Data Sources Compilation

Two systematic literature reviews were conducted for the Global Calcium Dashboard. The first compiled available dietary assessment studies of reported calcium intake during pregnancy and the incidence of MHD [10]. All studies reporting calcium intake through foods, drinks, fortified food or drinks, and supplements during pregnancy were included. We did not exclude any study for reporting or not reporting supplement intake or intake of fortified foods or drinks. The second systematic review gathered information on national antenatal care guidelines for each WHO country, including calcium-related policies, such as dietary recommendations and calcium supplementation [11]. The methods and results of these reviews have been described elsewhere.

Apparent calcium intake (ACI) from the nutrient balance sheets (NBSs), estimated using food balance sheet (FBS) data and additional data sources, was included to provide a more comprehensive and standardized method to estimate calcium intake in each country [12]. ACI from the NBSs includes only food sources of calcium derived from agriculture and excludes external sources of calcium, such as those provided through supplements or fortification. Additionally, ACI is derived as population group means. As a result, there is no information on ACI distributions (which are often right-skewed) in the NBSs [13]. Estimates of the burden of PTB measured in disability-adjusted life years (DALYs) lost per unit of population (DALYS/100,000), the burden of MHDs (DALYS/100,000 and deaths/100,000), and the risk of bone fractures (incidence rate/100,000) come from the Institute for Health Metrics and Evaluation's (IHME) Global Burden of Disease 2021 study (GBD), which publishes national estimates for numerous health outcomes [14]. Additional national estimates for PTB (incidence rate/100 live births) were published in *The Lancet* using data from 2020 [15].

The information on calcium fortification comes from the Global Fortification Data Exchange (GFDx), a website that maintains updated information on fortification legislation for maize flour, oil, rice, salt, and wheat flour [16]. While these are the most commonly fortified foods, legislation for calcium fortification of other food vehicles is not included.

2.2 | Typology Creation

We aimed to synthesize the variables related to calcium health that are included in the Global Calcium Dashboard into a country typology of adverse maternal and neonatal adverse health risk and calcium intervention status, designated using two separate indices: an adverse health risk index and a calcium intervention index.

2.2.1 | Adverse Health Risk Index

For the adverse health risk index, we combined MHD, PTB, and ACI and expressed them on a common scale. We excluded the variable bone fractures since the variable is not explicitly associated with maternal and neonatal health outcomes [17].

We selected the more encompassing DALY data for MHD since deaths are included in the metric. We excluded MHD incidence (i.e., for preeclampsia and eclampsia) given the sparseness and varied representativeness of the data. It is also an input variable in the DALY calculation and, therefore, redundant. For PTB, we chose the variable modeled by the IHME GBD project as opposed to the primary data reported in the systematic literature review. Due to the number of missing country data points from the *Lancet* review, the use of this variable would have resulted in many missing results in the final subindex. Likewise, we used the ACI versus the compiled calcium intake data from the systematic literature review due to the varied representativeness of the estimates, the many missing values of calcium intake, and the desire for data from as many countries as possible to produce the adverse health risk index.

To combine the selected variables, we first used the point estimates for MHD, PTB, and ACI and produced normalized scales of each variable from 0 to 1 using min-max scaling [18]. To ensure that each variable was oriented in the same direction, we subtracted the normalized values of ACI from 1 to match the direction of MHD and PTB. We chose to normalize the variables as opposed to using standardization because we are interested in the positions of the values relative to the full range and how these might change over time, as opposed to their distance from the mean.

Next, the normalized variables were combined as means, and the resulting values were again expressed on a 0–1 scale using min-max scaling. We used equal weights for the variables. Finally, we assigned each country's index risk designation as "high" or "low" based on values above or below the median of this final scale, respectively.

Globally, 22 countries did not have data on ACI. To prevent these countries from dropping out, we created a second scale using the mean of normalized values of MHD and PTB only and rescaled to 0–1 for all countries. As above, we assigned each of the 22 countries' designation as "high" or "low" based on values above or below the median of this final scale, respectively.

2.2.2 | Calcium Intervention Index

For the calcium intervention index, we used the variables calcium fortification legislation (CFL), food-based calcium recommendations (FBCR), and calcium supplementation guidelines (CSG). For each country, these variables are presented as binary "no/yes" data indicating that the country either has fortification legislation or not, has official food-based calcium recommendations or not, or has official calcium supplementation guidelines or not.

To create the calcium intervention index, a simple count of these three variables was conducted for each country, resulting in potential values ranging from 0 to 3. We then assigned each country's intervention status as "low" if the total count from the three variables was 0 and "high" if the total count was greater than or equal to 1. We did not offer additional consideration for countries that have fortification legislation related to mandatory versus voluntary fortification or for multiple food vehicles, and did not distinguish among the different food-based guidelines or calcium supplementation guidelines.

2.2.3 | Typology Classification

Four final typology categories were created based on the binary classifications from the two constructed indices. Category 1 includes countries requiring the most urgent attention and that are correspondingly classified as "high" based on risk and "low" based on intervention/policy environment. Category 2 includes countries classified as "high" based on risk but "high" based on intervention/policy environment, potentially indicating either additional or optimized resources or strategies to augment current efforts. Category 3 includes countries categorized as "low" based on risk but also "low" based on intervention/policy environment, possibly suggesting the need for surveillance to monitor any increasing risks that may warrant further attention. Finally, category 4 includes countries categorized as "low" based on risk and "high" based on intervention/policy environment, suggesting either that current intervention policies are working and/or that there are intervention safeguards in place to ensure that risks remain low.

2.3 | Visualization and Dashboard Implementation

For the website, the datasets were divided into three domains: health outcomes (PTB, MHD, and bone fractures), calcium intake (calcium intake among pregnant women and ACI), and policy landscape (calcium fortification and antenatal care guidelines). Each dataset and the country typologies were mapped using a color scale on individual pages along with supporting information, including background, strategic applications, and relevant references.

Values and information can be seen by hovering over a specific country. If more than one study was identified from a country in the systematic reviews, we used the largest, most recent, and/or most representative study in the map with the color scale. However, all data that was identified is available for download on the website. Clicking on the country from any map or going to the country directory takes users to country-specific pages. These pages were created to summarize all the available data for each country, along with the references for the data.

3 | Results

The Global Calcium Dashboard, including downloadable datasets, can be found at www.nyas.org/calciumdashboard.

3.1 | Dashboard Data

For the health outcomes, the first data domain, we considered PTB, MHD, and bone fractures, which are shown in Figure 1. The GBD estimates for each of these health outcomes included 204 countries [14], and the *Lancet* estimates for PTB included 103 countries (Table S1) [15]. The literature review for preeclampsia and eclampsia rates identified studies from 57 different countries, though many countries had multiple studies (Table S2). PTB and MHDs were generally highest in South Asia and in sub-Saharan Africa, and lowest in Europe (Table S3). Bone fracture incidence rates are highest in Australia, Europe, and Northern Asia, while lower rates are found in Africa and South Asia (Table S4) [17].

The second data domain covers calcium intake and is shown in Figure 2. The literature review found 179 studies of calcium intake in pregnant women from 40 countries (Table S5). Estimates of ACI were made for 191 countries (Table S6) [12]. The highest ACI were in Europe, Central Asia, and North America, while the lowest intakes were in Africa and several island nations in the South Pacific and Caribbean.

The third domain assessed the national policy landscape for calcium, including food fortification and antenatal care guidelines, and is shown in Figure 3. The GFDx provided information on fortification legislation for 196 countries, and 25 countries have legislation for calcium fortification (Table S7) [16]. All of these countries have standards for fortifying wheat flour, two have standards for fortifying rice (Belize and the United States), and two have standards for fortifying maize flour (the United States and Zambia). Most countries have mandatory fortification for at least one of the food vehicles, while seven have voluntary fortification. In most cases, the nutrient level in the standard is around 1250 mg/kg, but some nutrient levels go as high as 2400 mg/kg.

A systematic review of antenatal care guidelines from WHO member states found food-based recommendations for calcium in 36 countries and calcium supplementation recommendations in 38 countries (Table S8) [11]. The majority of countries with food-based recommendations are in Europe and South Asia (Table S9). Thirteen of the countries with supplementation recommendations are located in Asia, and 12 were in Latin America. In general, supplementation was recommended for women with either low intake or at risk for MHD, but seven countries (Afghanistan, Bhutan, Colombia, the Dominican Republic, India, Maldives, and South Africa) recommended supplementation for all pregnant women.

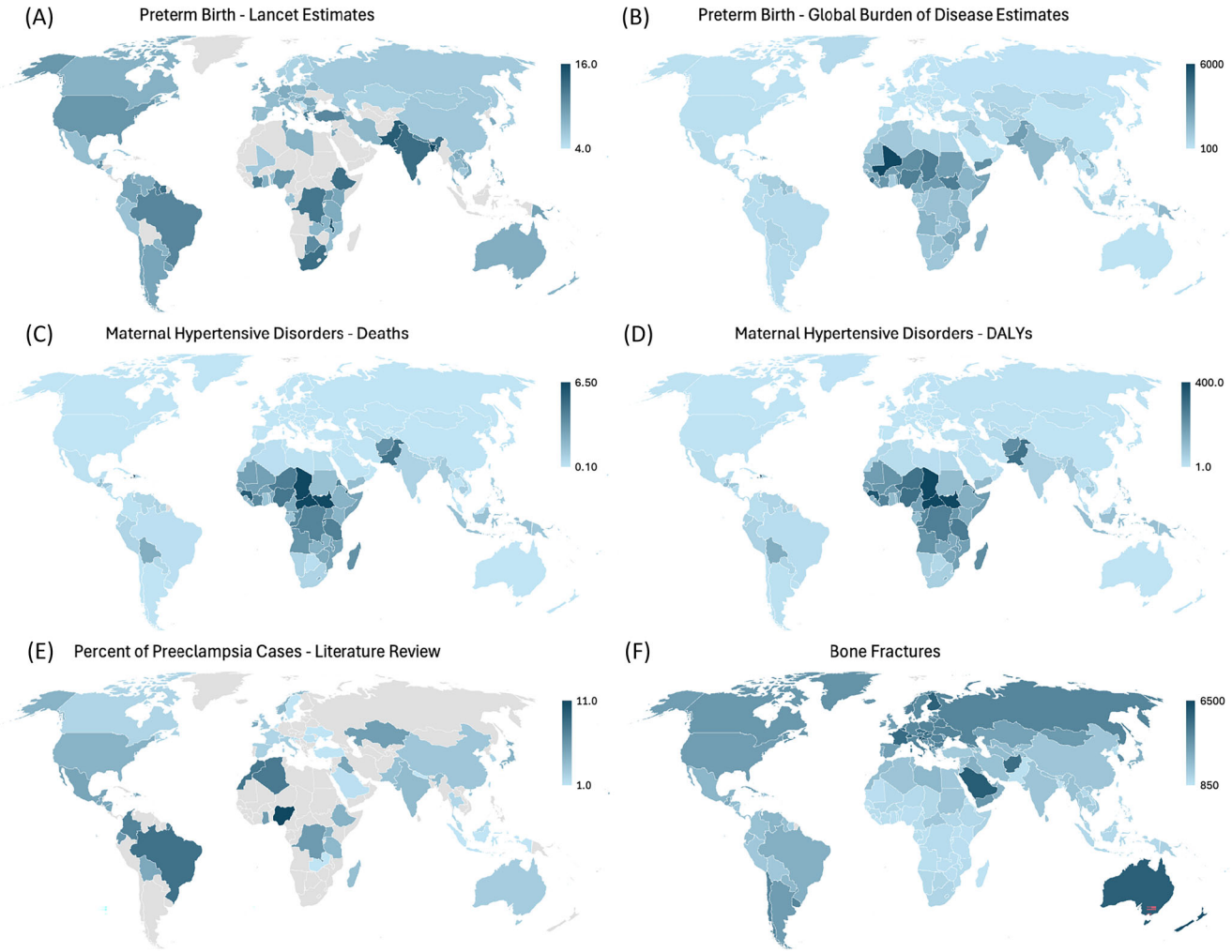

FIGURE 1 | Health outcome maps. (A) Preterm birth rate per 100 live births from 2020 published in *The Lancet*. (B) Preterm birth shown as disability adjusted life years (DALYs) per 100,000 from the GBD 2021 study. (C) Deaths per 100,000 from maternal hypertensive disorders from the GBD 2021 study. (D) DALYs per 100,000 from maternal hypertensive disorders from the GBD 2021 study. (E) Percent of preeclampsia cases based on a systematic literature review—the studies from India and Madagascar only presented values that combined the percent of preeclampsia and eclampsia cases and the values for Bolivia, the Dominican Republic, Guatemala, Honduras, and Nicaragua come from one study that presented only the combined percent of preeclampsia cases for all five countries. (F) Bone fracture incidence rate per 100,000 from the GBD 2021 study.

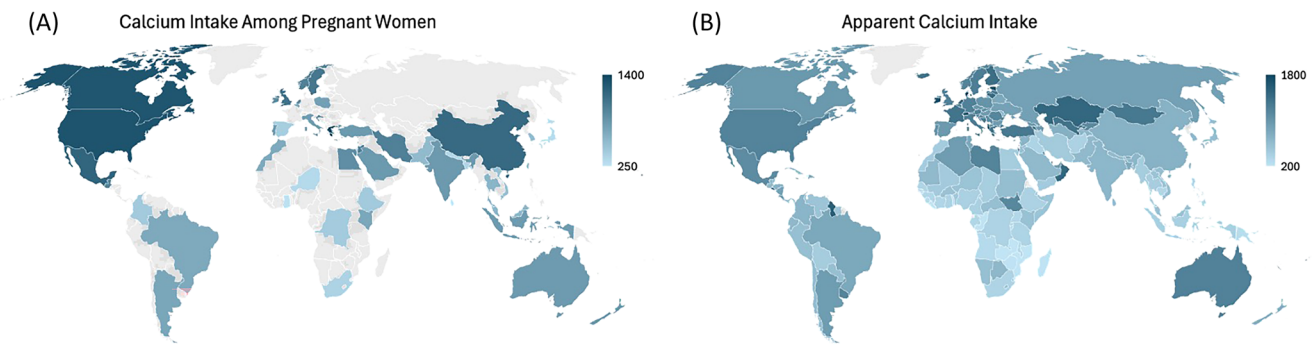

FIGURE 2 | Calcium intake maps. (A) Mean calcium intake (mg/day) among pregnant women based on a systematic literature review—the study from Colombia presented only median data and the data for Sweden is from a study that combined calcium intake for Norway and Sweden. (B) Apparent calcium intake (mg/day) from 2022 based on NBS data [12].

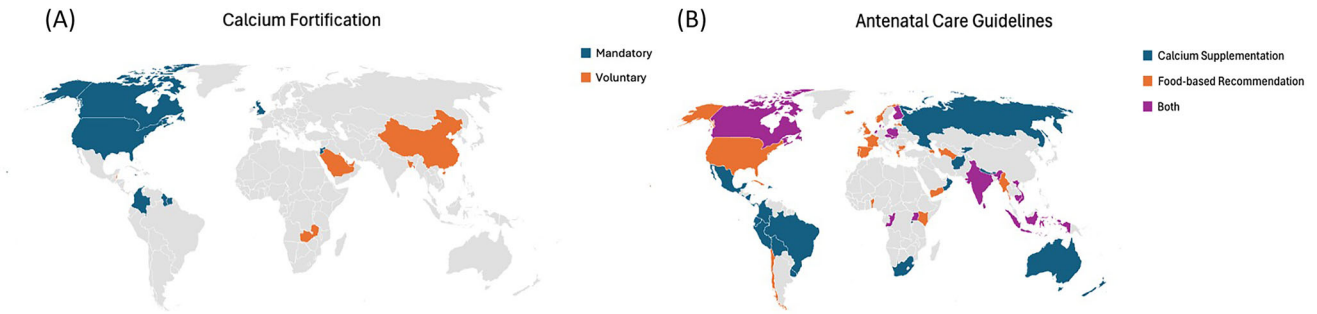

FIGURE 3 | National policy landscape maps showing countries with (A) calcium fortification standards with mandatory (blue) or voluntary (orange) fortification policies; and (B) antenatal care guidelines that include recommendations for calcium supplementation (blue), food-based recommendations (orange), or both (purple).

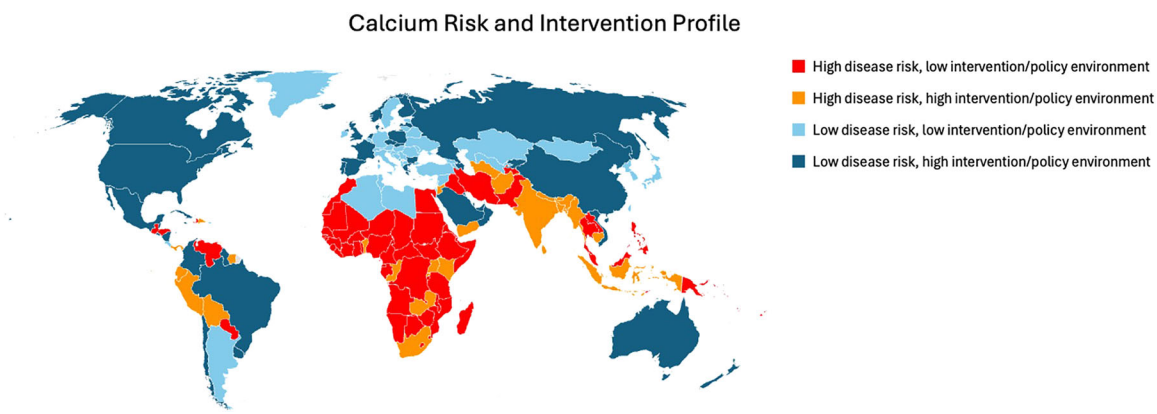

FIGURE 4 | Calcium risk and intervention profile map showing the country typology, which is either high disease risk with a low policy environment (red), high disease risk and high policy environment (orange), low disease risk and low policy environments (light blue), or low disease risk and high policy environments (dark blue).

3.2 | Country Typologies

A map of the resulting typology of adverse maternal and neonatal health risk and calcium intervention status is shown in Figure 4, and a corresponding table of the typology results and input variable values is shown in Table S10. We found that the regions of generally low risk often coupled with high intervention and policy environments (categories 3 and 4) are North America, Europe, Northern Asia, East Asia, and Australia, shown in light and dark blue in Figure 4. By contrast, those of greatest urgency in general are the African continent, South Asia, and Southeast Asia, while several countries in Central Asia, the Middle East, and Central and South America also have elevated risks.

Most African countries generally fall into category 1, shown in red in Figure 4. Only a few African countries—Benin, Kenya, the Republic of Congo, South Africa, Uganda, and Zambia—are in category 2, shown in orange, illustrating the need for additional resources to address the risks of adverse outcomes related to insufficient calcium intake in other areas of the continent.

With the exceptions of Brunei, Singapore, and Vietnam, countries in South and Southeast Asia are all in the high risk category. While most countries in these regions have some intervention/policy legislation and are, therefore, in category 2, shown in orange, Pakistan, Lao PDR, Thailand, and Malaysia fall into category 1 in red because they have no intervention or policy guidelines in place. The countries of Melanesia (Fiji, Papua New Guinea, Solomon Islands, and Vanuatu) also fall into category 1 and likewise warrant attention.

Several countries in the Middle East and Central Asia fall into high risk categories 1 and 2. Of these, Iran, Iraq, and Tajikistan have no intervention and policy guidelines in place. Finally, 11 countries in Central and South America fall into high risk categories 1 and 2. These are particularly notable given they are embedded in regions that generally exhibit low risk and high intervention and policy environments shown in the deep blue of category 4. Of these high risk countries, Guatemala, Haiti, Honduras, Paraguay, and Venezuela do not have intervention and policy guidelines in place.

4 | Discussion

The Global Calcium Dashboard collectively shows that many regions of the world are at risk of inadequate calcium intake and related health outcomes. While there are national policies and guidelines available for nutrition interventions, such as calcium

supplementation and food fortification, these are often not in place where they may be needed the most.

Included in the Global Calcium Dashboard are several variables that are complementary in their perspectives, representativeness, and span of countries included. We included two sets of modeled estimates of PTB (from *The Lancet* and the GBD) [14, 15]. The *Lancet* data are based on the incidence rate and, therefore, indicate the risk among live births, while the GBD data cover twice as many countries and, in presenting the DALYs/100,000 persons, provide a more complete indicator of the severity and burden of the subsequent impacts. The rank-ordering of the data from models were largely in agreement when sorted from highest to lowest severity. However, there were some exceptions, such as Greece and the United States, which were in the top 20% (with the 11th and 19th highest rate, respectively) in the *Lancet* estimates of PTB but ranked in the lower half of the GBD estimates (161st and 140th). This could be due to differences in factors such as the birth rate or age distribution of the population that may differentially affect countries, or due to differences in model specification and assumptions that may affect resulting estimates from the models.

We included three sets of data related to MHD. Similar to PTB, we used the burden of MHD in DALYs/100,000 persons, but also the mortality of MHD in Deaths/100,000 persons [14]. These variables exhibited similar ranking when ordered from highest to lowest severity, indicating that deaths are a significant driver of the burden of MHD. We also included the incidence of preeclampsia and eclampsia from a literature review, which included primarily non-nationally representative data for many fewer countries that highlight the considerable variation in the distribution of MHD. For example, Ethiopia, India, and Thailand varied in their ranks (36th, 67th, and 131st, respectively) based on the GBD estimates of DALYs/100,000 persons (out of 204 countries). However, data from the literature review shows that their within-country rates include some of the highest preeclampsia rates in certain regions but also show substantial variation across regions and over time.

We also included two variables related to calcium intake. The first, simply called calcium intake, is based on a literature review of traditional dietary assessment studies of calcium intake among pregnant women. The various methods include diet histories, diet records, food diaries, food frequency questionnaires, semi-quantitative food frequency questionnaires, 24-h (and less commonly 48-h) dietary recalls, food records, and weighted food records. In a few studies, the methods were specified as "own design" or unspecified. While the specific methods vary and present different sources of error [19], the strength of inclusion of this variable was that each method aimed to assess individual intake of calcium consumed over the reference periods and assessed within-country variation in intake for selected subnationally representative areas in 49 countries. Further analysis for specific populations and decision-making should differentiate methodologies, as some may require adjustments to properly estimate calcium intake inadequacy.

To complement the narrower scope of countries and incomplete representativeness offered by the calcium intake variable, we included a variable of ACI from the NBS, so-called because it is an indirect measure of consumption and intake. The primary underlying data for ACI comes from the FAO FBSs, which are methodologically constructed based on food disappearance (i.e., calculating all out-flows from agricultural production and international imports) [20]. FBS data estimate country food availability because they are based on primary raw food equivalents and do not account for food loss and waste at the retail and household level [20]. The NBS further strives to account for food loss and waste at the retail and household level, as well as losses from cereal processing, losses from average food preparation and cooking methods, and bioavailability of select nutrients (with the resulting value considered to be a measure of apparent intake). However, many potential sources of error also arise from this approach and the many data sources used, and the potential for overestimation of true dietary intake remains high [12].

Despite the factors described above in comparing calcium intake with ACI, we do note that, in general, the trends in highest and lowest intake were similar between these variables. Although, in some cases, we also observed substantial variability between the national estimates and the regionally representative estimates, such as in Jordan, Iran, the Netherlands, and Ireland.

With respect to bone fractures, they occurred most often in older people, especially those with osteoporosis. As a result, many countries with older populations also saw the highest fracture rates [17]. Other major contributors of bone fractures came from occupational hazards, and the authors of the GBD study suggest that greater safety measures should be in place to prevent such injuries [17].

When using the Global Calcium Dashboard, we recommend reviewing the various data sources to triangulate areas that require specific focus for advocacy or for additional research. This is due to the many differences in these variables (study design, study population, unit of observation, method of data collection and calculation, reference period, food composition table and other data sources utilized, level of representativeness, etc.). It is only possible with these data in the Global Calcium Dashboard to note differences and variation rather than assign a label of correctness.

In terms of interventions, food fortification is an important method to improve calcium intake across a large population [21]. Some of the lowest apparent intakes of calcium were found in the Caribbean, but currently available estimates do not include food fortification [12]. In fact, 11 of these island nations adopted mandatory food fortification in 1995 that included calcium (1250 mg/kg for wheat flour) [22]. If these programs are well implemented, they should at least attenuate, if not eliminate, the risk of low calcium intake in these settings [23]. Countries with similarly low calcium intakes may also want to consider fortifying foods with calcium to improve intake, which has been done in the Caribbean [24, 25].

There was a wide variety of high-, middle-, and low-income countries with antenatal care guidelines that recommend calcium supplementation and with food-based recommendations. All the food-based recommendations mentioned consuming dairy. Thus, dairy should be made more accessible to vulnerable groups in countries where little dairy is consumed. However, in addition to dairy, many countries also included recommendations for a

variety of other foods, including small fish with bones, leafy greens, nuts, and pulses [11]. In addition, a few even contained very specific local recommendations, such as ragi (or finger millet) in India and specific brands of calcium-rich mineral waters in France to help guide choices [26, 27]. Future research might focus on whether greater specificity in the guidelines leads to greater adoption of the guidelines.

4.1 | Country Typologies

The country typologies and corresponding map of adverse health risk associated with low calcium intake and existing intervention/policy environments produced in this study serve as a first step guide to orient policymakers' attention to areas of need for consideration of resource allocation to address existing risks. Given that the results could be sensitive to the selection of variables and their representativeness for any specific country, these results should be further confirmed and triangulated with additional data to confirm the magnitude and distribution of risk and the existence and performance of any current interventions or policies. For example, we used the PTB variable produced from the IHME GBD project, which estimates the total national burden of PTB in the population per 100,000 persons. While we expect this variable to be correlated with the PTB rate per 100 live births published in *The Lancet*, differences in birth rates and other variables could lead to differential results across countries, as noted above. Likewise, we chose not to use calcium intake due to the varied availability and representativeness of the variable and instead used ACI estimated from FBSs and other sources. The differences in variable estimation could lead to important differences that could impact the results shown here.

In addition to variable selection, the method of index construction could also affect results. For example, in developing the adverse health index, we combined the normalized variables using unweighted means, thus treating the importance of each variable equally, and we created our binary classification based on resulting values above and below the median. Employing a weighting scheme and/or identifying a less arbitrary cutoff to designate "high" and "low" risk would likely affect these results; however, we did not identify strong reasons to employ either approach in this study. For the intervention and policy environment index, we classified countries as either "low" or "high" based on a simple count of zero versus any existence of intervention or policy guidelines. This was driven by the result that 127 countries had a count of zero, while 76 countries had a combination of only 1 or 2, and only one country had a count of 3. However, another approach to quantifying the intervention and policy environment or cutoff value would affect the final results shown here.

As a sensitivity analysis, we combined the variables from the adverse health risk index using a geometric mean as opposed to an arithmetic mean to dampen the influence of potentially having one extreme variable contributing too much weight. Overall, the classification results were largely maintained as the use of the geometric mean resulted in a change in typology category for only 15 of 204 (7%) total countries. Algeria, Belize, Guyana, Grenada, Jamaica, Palau, Seychelles, and Tonga were classified as "high" risk using the geometric mean versus "low" using the arithmetic mean, while Iran, Jordan, Malaysia, Panama, Saint Lucia, Sri Lanka, and Thailand were classified as "low" risk versus "high" based on the arithmetic mean.

Finally, when considering the results of these typology classifications, policymakers should also consider them relative to other important disease burdens and the interventions available to mitigate those disease burdens. When considering the allocation of resources, analyses of the costs and benefits associated with addressing inadequate calcium intake and its related adverse health risks should be conducted. Additionally, comparisons of the potential cost-effectiveness of candidate interventions with those available to combat other disease burdens should be carried out to ensure that resources are efficiently, effectively, and impactfully deployed and focused on the conditions of greatest need.

4.2 | Challenges and Limitations

To our knowledge, the Global Calcium Dashboard is the only publicly available tool that incorporates datasets from disparate sources to help triangulate regions with the greatest need and potential to benefit from calcium interventions. It allows professionals from all backgrounds and disciplines to utilize available data for the purpose of prioritization and decision-making. The greatest challenge and limitation of this project was the availability of representative primary data on calcium intake and related health outcomes. Decision-makers deserve to have the best data at hand to make informed decisions, but reliable primary data often does not exist. As a result, we and others are very reliant on modeled estimates. Thankfully, many modeling groups, as well as the GFDx, make their estimates and data freely available, which has allowed us to combine their information with those from our systematic reviews. However, we have not been able to find data on PTBs that have been directly caused by MHD, and similarly, not all MHDs result in a PTB. As a result, the dashboard is only able to list the incidence, DALYs, or deaths associated with these outcomes, knowing that in some cases, the two health outcomes are linked.

The systematic reviews that have been conducted for this project included comprehensive search strategies, but it is always possible that eligible studies were missed. Similarly, when searching for antenatal care guidelines, we were reliant on the information being available online. If a country has not published their guidelines in a publicly available format online, we would be unable to find it and include their guidelines in our information.

Finally, the dashboard is limited to information on guidelines for supplementation and food fortification policies for specific food vehicles and does not consider their implementation. Future studies could review if calcium supplementation guidelines or food fortification policies are being implemented.

5 | Conclusions

In the future, more current and representative primary data would strengthen what is known about calcium intake and related health outcomes. As with other micronutrients, there is

not only a need for more national, but subnational data due to the variation in diets and health profiles across a country (e.g., income, rural vs. urban, or mountain vs. seaside). A population-based biomarker of calcium status would also be invaluable. Calcium intake is a helpful indicator, but it is difficult to know how the bioavailability of calcium in foods affects calcium status within a population with specific dietary patterns, especially for those who rely more on plant-based sources of calcium than those consuming animal-based sources, such as dairy. A biomarker may also help identify pregnant women who may benefit the most from calcium supplementation.

The Global Calcium Dashboard serves as a valuable planning tool to identify regions where calcium interventions may have the greatest impact. This data can be used by researchers in planning for future studies, used by local and international groups for advocacy purposes, and by decision-makers who may want to develop interventions to support calcium intake in their contexts. Calcium supplementation during pregnancy is an especially useful intervention for the prevention of MHD and subsequent cases of PTB. Given the high rates of these health outcomes and low calcium intake, especially in LMICs, there is a significant need to support calcium-based interventions.

Author Contributions

The authors' responsibilities were as follows – M.W.B., F.G., and Z.H.R. designed the project, M.W.B. and Z.H.R. led the development of the website, G.C. developed the protocols and led the systematic literature reviews, K.L. developed the methodology and performed the analysis of the country typologies. M.W.B. and K.L. had the primary responsibility for writing the manuscript, and all authors have reviewed and approved of the final content.

Conflicts of Interest

The authors declare no conflicts of interest.

Peer Review

For transparency, the peer review documents associated with this article are available at https://doi.org/10.1111/nyas.70286.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supplementary Tables: nyas70286-sup-0001-tablesS1-S10.docx