OMNIPLaNT Report, UK care sector: How the demand for vegetarian and vegan foods could change over the next 10 years

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Introduction

The number of 65+ year olds living in the UK during the latest census had risen from 16.4 % of the population (in 2011) to 18.6 % by 2021, roughly translating to 11 million people [1]. It has previously been estimated that ~279,000 of those over 65 years were living in care homes between 2021-22 [2]. It is anticipated that the age of the UK population will continue to rise, bringing with it numerous challenges for national health services including greater demand for care home residencies and subsequent provisions for the older population [3]. Nutritional interventions have been identified as potential strategies to help mitigate, at least in part, some of the anticipated strain placed on the health services that are a likely consequences of an ageing population [4]. Despite this, research has demonstrated that care staff lack the appropriate nutritional education to support residents in healthy ageing [5].

A legitimate concern raised in recent years is that some care home residents may opt to abstain from the consumption of meat and animal products in line with personal beliefs, typically centred around religion, animal welfare, environmental protection or personal health [6]. A previous report conducted by the All-Party Parliamentary Group on behalf of Vegetarian for Life highlighted numerous anecdotes in which care home residents following plant-based diets were not accommodated by care staff [7]. For example, a care home employee recalled:

"*In one home we were looking after a 95-year-old woman. She was non-verbal and couldn't move her arms and legs without our help. We gave her the same meals every day: porridge for breakfast and minced meat with mashed potatoes and peas for dinner and for tea, but she often refused the food and became angry with us. New staff were told she was aggressive and a bite risk. One day I looked at her care plan and discovered that she was listed as being vegetarian. I was horrified. Her care plan hadn't been read or had been completely disregarded. When I spoke to the manager I was told to carry on feeding her meat as she needed it for nutrition. It was very sad and she passed away without things ever improving.*" [7].

To the author's knowledge this case was not legally challenged, however it is possible that care homes could face some form of litigation in cases where staff do not accommodate residents who adopt plant-based dietary patterns. It is often argued that plant-based diets should be legally recognised as a philosophical belief. In 2020, the UK experienced the first legal case in which a vegan diet was officially (and lawfully) recognised as a philosophical belief in line with the criteria outlined in the Equality Act 2010, in *Casamitjana Costa vs. The League Against Cruel Sports* [8]. Mr Casamitjana Costa won his appeal against an unfair dismissal at

an employment tribunal, which had occurred after he raised awareness of the company pension scheme which had investments in companies known to conduct animal testing [8]. It was ruled that Mr Casamitjana Costa's 'ethical veganism' satisfied the definition of a philosophical belief, as his beliefs had a significant impact on his life specifically due to the seriousness of his actions, such as refusing to handle money that had been contaminated with animal products. This is an important detail in the result of the appeal, highlighted in an earlier case in which the same judge ruled 'ethical vegetarianism' not to be a philosophical belief, deeming it to be more of an opinion, in the case of *Conisbee vs. Crossley Farms Limited* [9]. This suggests that there may (currently) be an arbitrary and undefined threshold related to the seriousness and cogency of an individual's belief that must be satisfied to attain legal protection as a plant-based dieter in the UK.

There are also examples of successful legal cases (in favour of plant-based dieters) in European Human Rights Courts, albeit not based in the UK. Vegan and vegetarian dieters and advocates have interpreted various articles from international human rights declarations to apply to their dietary beliefs. Article 18 if the Universal Declaration of Human Rights states:

"*everyone has the right to freedom of thought, conscience and religion; this right includes freedom to change his religion* ***or belief****, and freedom, either alone or in community with others and in public or private, to manifest his religion or belief in teaching, practice, worship and observance*" [10].

The specific inclusion of '*belief*' separately to '*religion*' has been interpreted to refer to secular beliefs that could include both vegan and vegetarian lifestyles. In *Jakobski vs. Poland* and *Vartic vs. Romania* plaintiffs raised legal challenges after being denied vegetarian meals whilst incarcerated and were successful on the grounds that their dietary choices were an extension of a belief system that would satisfy the criteria outlined in Article 18 [11]. This is of particular importance in the care setting as plant-based residents would require accommodation of their dietary choices similar to those seen in the prison setting. Considering recent legal history in the UK, those deemed to be 'ethical vegans' would likely be successful in certain legal situations, whereas those with a more relaxed approach to veganism or 'ethical vegetarians' would likely have difficulty trying to attain the same legal protection.

There are also additional legal considerations specific to care homes, in which staff must consider the Mental Capacity Act 2005, which outlines that an individual's previous wishes and feelings must be respected even if they are no longer capable of expressing them as a result

of some form of cognitive decline, such as those suffering with dementia [12]. Subsection 6 of the Mental Capacity Act 2005 states:

"*The decision-maker must also consider, as far as reasonably ascertainable, the "past and present wishes and feelings" of the person concerned. Such wishes and feelings would include any relevant written statement. Even where people cannot make their own decisions, they can express preferences and feelings which should be taken seriously. For those who have lost capacity (for example because of progressive dementia) it may be particularly important to consider past wishes and feelings… There must also be consideration of the person's beliefs and values – religious beliefs, cultural values and lifestyle choices are obvious aspects of this*" [12].

As seen with other legal Articles, the specific inclusion of 'lifestyle choices' alongside 'religious beliefs' can be interpreted as being applicable to dietary choices such as veganism and vegetarianism. In this context, care staff would be required to accommodate a resident's plant-based diet even if they had lost cognitive faculties and were unable to voice their wishes. It would, however, facilitate both the accommodation or the legal challenge if the resident (or a loved one) had officially recorded their dietary choices upon entry into the care system. To the author's knowledge there have not yet been any legal cases in which plant-based dieters have challenged a care home, but this does not mean that these situations are not occurring across the UK (as seen earlier in the report).

As such, the risk of potential litigation and the necessity for the care sector to accommodate plant-based foods may be increasing as the prevalence of plant-based diets has drastically increased in recent years. Estimates as far back as the 1940s suggest that ~0.2 % of the population were vegetarian [13], which had risen to 1.8 % by the 1980s [13]. A study conducted on behalf of The Vegan Society showed that the prevalence of vegan dieters across the UK quadrupled between 2014-19, rising from 150,000 to 600,000 [14]. Peer-reviewed data from the UK National Diet and Nutrition Survey indicates that the consumption of plant-based food products increased by 115 % between 2011-19, with individuals self-reporting consumption increasing from 6.7 % to 13.1 % [15].

Given the rise in popularity and prevalence of plant-based dieters in the UK, in combination with an ageing population that looks set to continue, care homes are likely to face an increasing prevalence of vegan and vegetarian dieters over the coming decade. Currently, there is no peer-reviewed evidence projecting future prevalence of plant-based dieters in the UK, nor in the

care sector. The aim of the current analysis, therefore, was to estimate the current prevalence of plant-based dietary patterns in the UK and perform a basic forecast of potential changes in the future prevalence, based on publicly available historical data. In addition, the current analysis aimed to project future prevalence of older adult plant-based dieters living in care homes.

Methods

Data sources

Secondary data were initially collated from a variety of sources including the Office for National Statistics (ONS), YouGov databases and Vegetarian for Life. To determine current and historical prevalence of plant-based dieters across the UK, data were collated via a YouGov database [16]. Briefly, according to the method outlined by YouGov, samples were constructed via active sampling within a large database of potential respondents. Participants were selected to construct a subsample that is representative of the wider population and were privately invited to complete an online survey, in this case regarding their preferred dietary pattern. The sample size of each survey used for the current analysis varies slightly between time points. A mean sample size across each time point was therefore reported for each subsample analysis (Figures 2 A-F*)*. The mean sample size across the 11 time points for the pooled sample was 2,004 respondents.

Census data collated by the ONS were sourced to determine the number of care home residents aged 65+ years [17]. This population represent the majority of care residents across the UK (82.1 %) and are the focus of extensive research into the nutritional considerations required for healthy aging [18]. Whilst there are other populations that exist within the care system, this population was chosen as most appropriate for the current statistical analysis as they provide a more homogenous population that are not only the target of extensive government policy, but also represent the largest proportion of care residents that are more likely to require support in situations that are aligned with Vegetarian for Life's charity work, such as dementia support. It should, however, be considered that there are additional populations living in the care system across the UK (17.9 %), that are not included in the projections, when interpreting the findings of the current analysis.

The census is a population-wide government survey conducted every decade to gain accurate and reliable data on the wider population. Online questionnaires (as well as paper versions if necessary) were self-reported by respondents across the UK population, with the response rate

maximised by enumerators who are employed to visit areas with low responses and facilitate individuals living in group settings to complete the survey. The most recent census was conducted was in March 2021 and had an 88 % response rate across all authorities. It is important to note that data collated during the census in 2021 was affected by the COVID-19 pandemic, during which the number of care homes deaths was abnormally high [19]. Due to the limited data available this census data is still included in the statistical analysis of the present investigation.

Data specifically related to the prevalence of vegetarians and vegans living in UK care homes were collated on behalf of Vegetarian for Life. Care homes managers were contacted directly via Computer Assisted Telephone Interviewing (CATI) and conducted by Pexel Research Services (Pexel ltd., Glasgow, UK). Participating care homes were asked a number of questions including whether there were any plant-based dieters (vegan and vegetarian) currently living in their residency in 2014 (n = 985 homes), 2019 (n = 1,000 homes) and 2024 (n = 1,011 homes). Both the percentage of homes currently housing '*at least* one' vegetarian and vegan, and the mean percentage prevalence of vegetarians and vegans in each home were calculated from the data.

Data analysis

Statistical projections were performed using linear regression analysis (Python Software Foundation, python.org), on historical data sourced from a YouGov database. The prevalence of plant-based dieters across the UK were estimated in a total pooled sample, in those living across various regions of the UK and individuals aged 50-64 and 65+ years old (Appendix 1). Projections were made at six-month epochs across a ten-year period, with each linear regression model trained using ten data points from survey data collated between 2019-2024. Bootstrapping was used to determine estimated 90 % confidence intervals (CIs) on forecasted data. Briefly, this consisted of constructing 1,000 random samples generated from the historical dataset with replacement for subsequent analysis via the original linear regression models. Variation in the regression coefficients, representing the error in each model, are plotted as a fan beam demonstrating 90 % CIs on each figure.

Further projections were made using census-derived data from an ONS database regarding the number of care home residents aged 65+ across the UK. This population were selected for forecasting analysis due to their specific relevance to the ageing population in the UK, and their relevance to the ongoing work by Vegetarian for Life, and the analysis was therefore focused

on ageing-related care home residency. A linear regression analysis was performed on three historical data points at ten-year epochs (2001, 2011, 2021) with forecasting performed at ten-year epochs across a 20-year period. Bootstrapping was performed for estimation of 90 % CIs across the forecasted data.

The proportion of care homes that contained '*at least one'* vegetarian or vegan was expressed as a percentage of the total sample of care homes surveyed in the 'Vegetarian for Life' conducted CATI data. The average percentage of vegans and vegetarians living per care home was calculated by determining the number of plant-based dieters relative to the total population of each individual home, with the mean percentage across the entire sample of care homes subsequently reported.

The timepoints at which data was collected on behalf of Vegetarian for Life (2014, 2019 and 2024) did not align with previous census data timepoints. Therefore, before it was possible to estimate an absolute number of plant-based dieters (aged 65+ years old) living in UK care homes during these years, the total number of care residents were estimated using a 2nd order polynomial regression analysis. Once an estimate of the total number of care residents had been attained, it was possible to estimate the absolute number of vegans and vegetarians living in care homes based on the mean prevalence living per care home observed in the Vegetarian for Life CATI data (Appendix 2).

Finally, linear regression analysis was performed on the mean percentage of plant-based dieters living per care home to forecast future estimated prevalence with bootstrapping (x1,000) to determine 90 % CIs. Forecasted percentages of plant-based dieters per care home could then be used in conjunction with forecasted number of care home residents to estimate the absolute number of vegans and vegetarians living in care homes over a ten-year period.

Results

Basic linear regression models performed on data collated from a pooled sample of plant-based dieters across the UK, using historical YouGov data, revealed estimates of ~2.8 % (1.8 – 4.4 %) and ~ 4.2 % (2.7 – 5.3 %) of the population that will follow vegan and vegetarian diets by 2034, respectively (Figure 1). This indicates that there may be an estimated ~1 % rise in the prevalence of vegans and a decline of ~1 % in vegetarians across the UK over the next decade. According to the upper bounds calculated during the linear regression analysis, the rise in the number of vegans could be upwards of ~2.5 % by 2034, whereas vegetarians may rise ~0.5 %.

In addition, the total number of meat eaters living in the UK is estimated to decrease slightly to 69.3 %- (62.7 – 74.2 %).

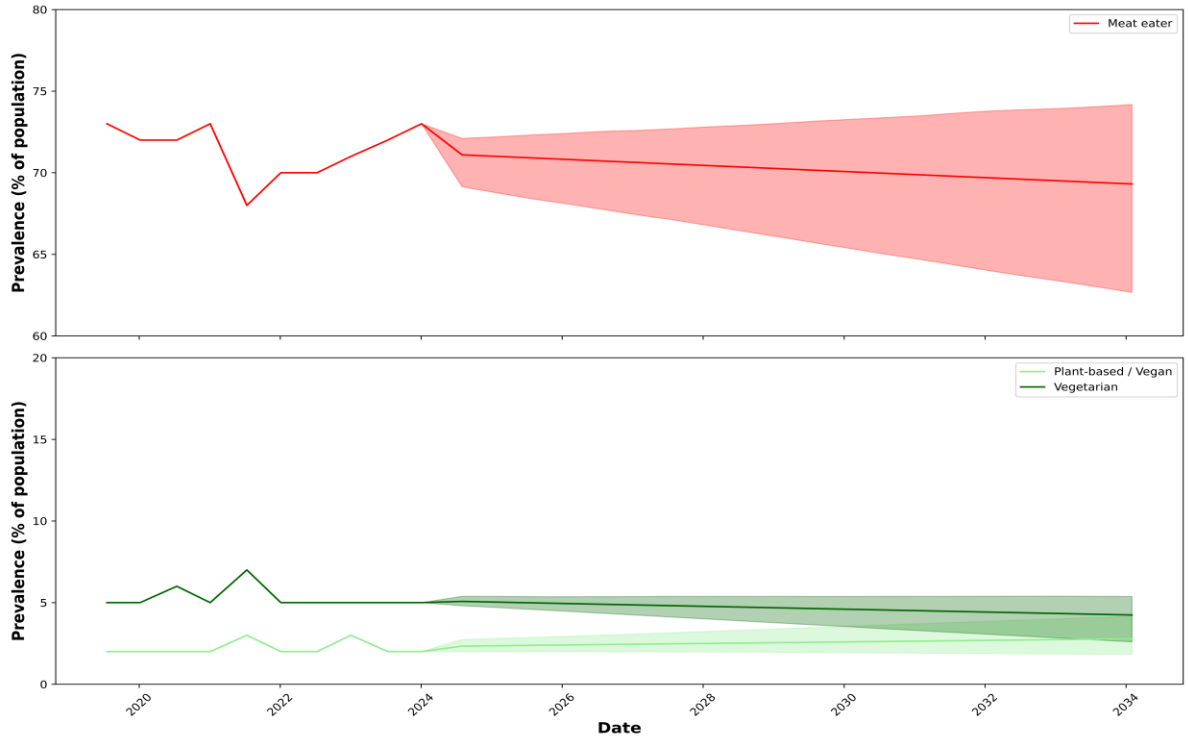


Figure 1. The prevalence and estimated projections of **A**, meat eaters (red line and fan beam) and **B**, vegan (light green line and fan beam) and vegetarian (dark green line and fan beam) dietary patterns across the United Kingdom plotted with 90 % confidence intervals generated via bootstrapping (represented by the coloured shaded area). Data was attained from a YouGov database on the prevalence of dietary patterns in the UK [20].

Regional analyses estimate that the prevalence of vegan and vegetarian dieters living in London may rise to 3.0 % (-1.4 – 7.4 %) and 6.2 % (0.9 – 10.5 %) by 2034, respectively (Figure 2 A). In Southern England (excluding London), the prevalence of vegans is estimated to be ~1.8 % (-0.9 – 4.1 %) and vegetarians ~2.9 % (0.8 – 4.7 %, Figure 2 B), whereas vegans in the Midlands are estimated to represent ~4.0 % (2.1 – 6.6 %) and vegetarians ~6.8 % (0.5 – 11.7 %, Figure 2 C). In Northern England, vegans are estimated to represent ~3.4 % (1.0 – 6.2 %) and vegetarians ~3.7 % (1.0 – 7.2 %) by 2034 (Figure 2 D). Alternatively, estimates conducted using data collated across Wales revealed a potential rise to 10.9 % (7.4 – 16.4 %) in vegans and 11.0 % (2.4 – 21.7 %) in vegetarians by 2034 (Figure 2 E), and in Scotland the prevalence of vegan is estimated to increase to 5.5 % (0.4 – 11.2 %) whereas vegetarians are estimated to decrease to 0.2 % (-2.6 – 3.7 %) (Figure 2 F).

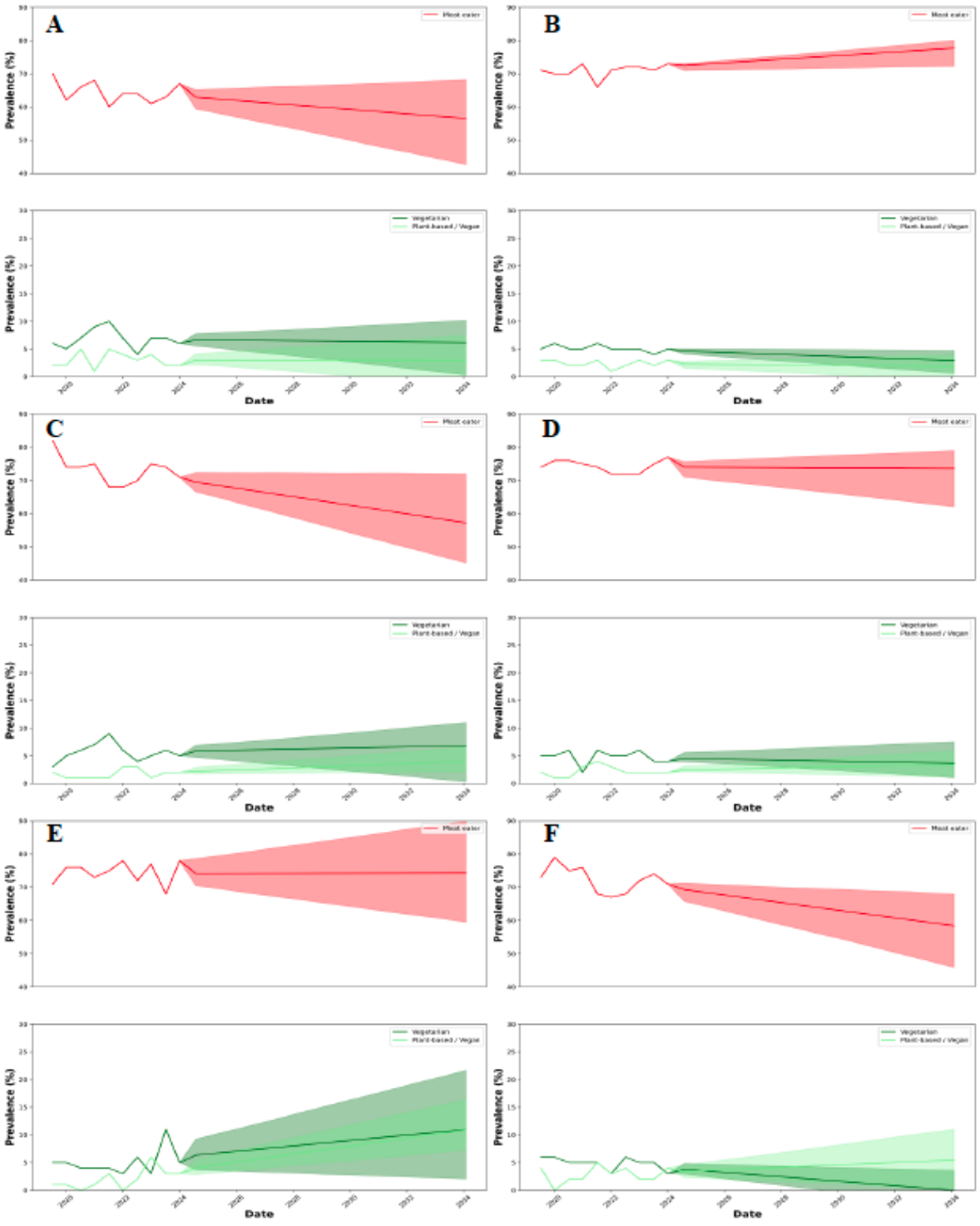


Figure 2. The prevalence of meat eaters (red line and fan beam), vegan (light green line and fan beam), and vegetarian (dark green line and fan beam) dietary patterns across regions of the United Kingdom, including; **A**, London (*n* = 271); **B**, South of England (*n* = 651); **C**, Midlands (*n* = 331); **D**, North of England (*n* = 479); **E**, Wales (*n* = 98); and **F**, Scotland (*n* = 174). Data was attained from a YouGov database on the prevalence of dietary patterns in the UK [20].

Additional analysis of the pooled sample, per age category, estimated the prevalence of vegans living in the UK aged 50–64-year-olds to be ~2.6 % (-0.1 – 5.4 %) and vegetarians ~4.1 % (-0.7 – 10.4 %) by the year 2034 (Figure 3 A). In individuals aged 65+ years old, the prevalence of vegans is estimated to be ~2.7 % (0.2 – 4.7 %) and vegetarians ~8.8 % (6.0 – 11.1 %) by 2034 (Figure 3 B).

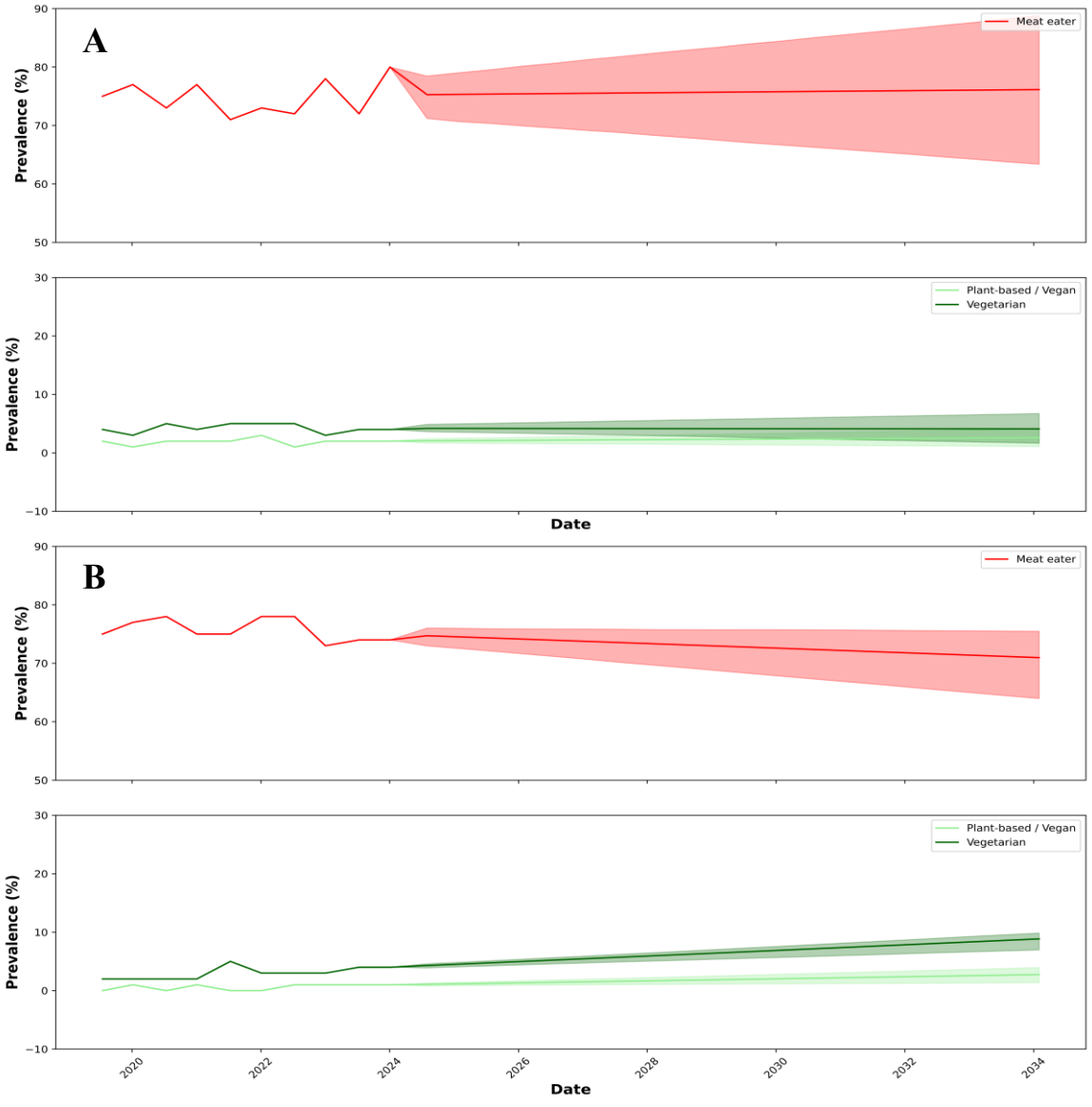


Figure 3. Prevalence of meat eaters (red line and fan beam), vegan (light green line and fan beam) and vegetarian (dark green line and fan beam) dietary patterns across the United Kingdom, including; **A,** 50-64 years (*n* = 479) and **B,** 65+ years (*n* = 463). Data was attained from a YouGov database on the prevalence of dietary patterns in the UK [20].

Census data collated by the ONS show that the number of care home residents aged 65+ years in the UK was ~290,000 in 2001, ~291,000 in 2011 and 279,000 in 2021. Linear regression analyses estimate the prevalence of care home residents to rise to ~348,300 (310,375-500,000) by the year 2031, and potentially rise to ~383,000 (324,368-570,000) by 2041 (Figure 4).

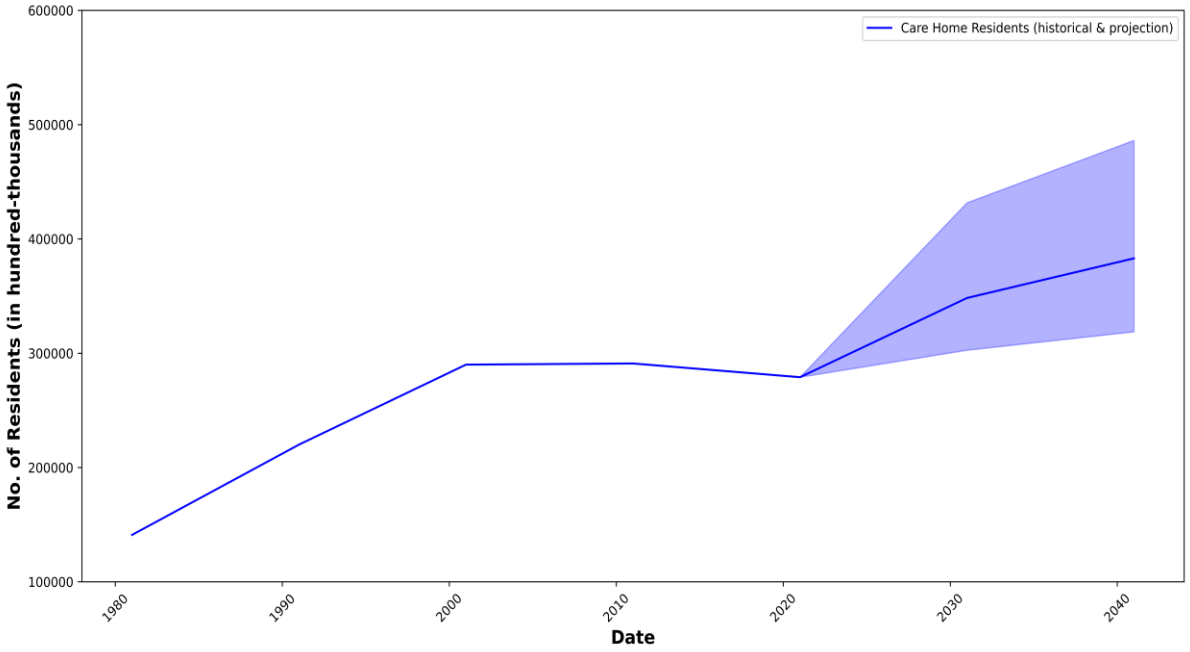


Figure 4. The number of care home residents aged 65+ years in the UK recorded via the national census survey conducted in 1981, 1991, 2001, 2011 and 2021, with linear regression forecasting projecting future prevalence of care home residents per decade (blue line), plotted with the 90 % confidence intervals for estimated prevalence of care home residents (blue fan beam). Data was accessed via the UK Office for National Statistics [21].

Data collated on behalf of Vegetarian for Life indicated that the number of care homes in the UK that contained *at least* one vegetarian was 22.7 % in 2014 and had risen to 31.8 % by 2024 (n = 1,011 care homes). The number of care homes containing '*at least* one' vegan was 2.2 % in 2014 and had risen to 2.6 % by 2024 (Figure 5). It should be noted that the 2019 data (which indicates a slight decline in the prevalence of care homes containing *at least* one vegetarian and vegan) should be interpreted with caution given the potential extraneous effects of the COVID-19 pandemic in UK care homes.

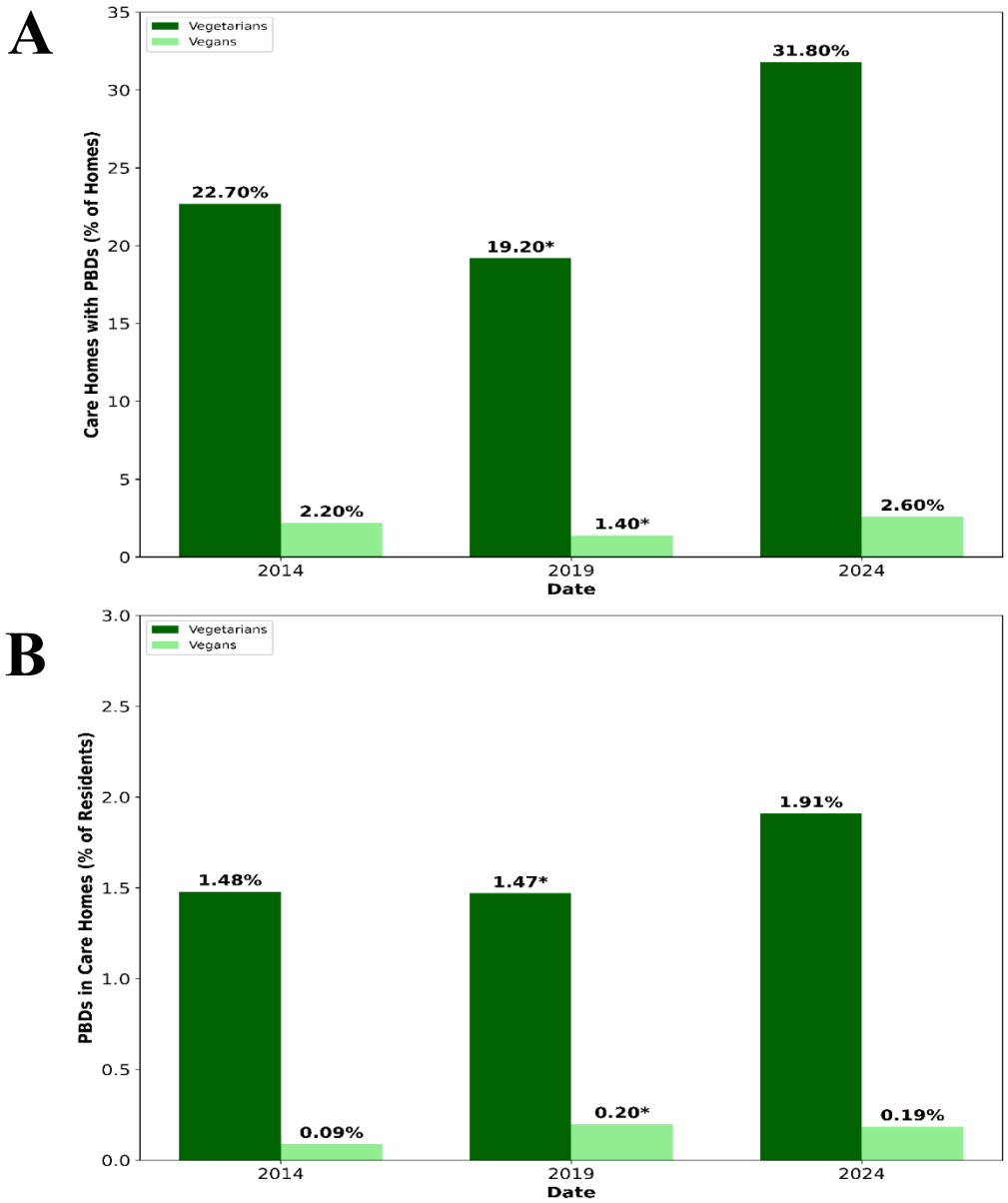


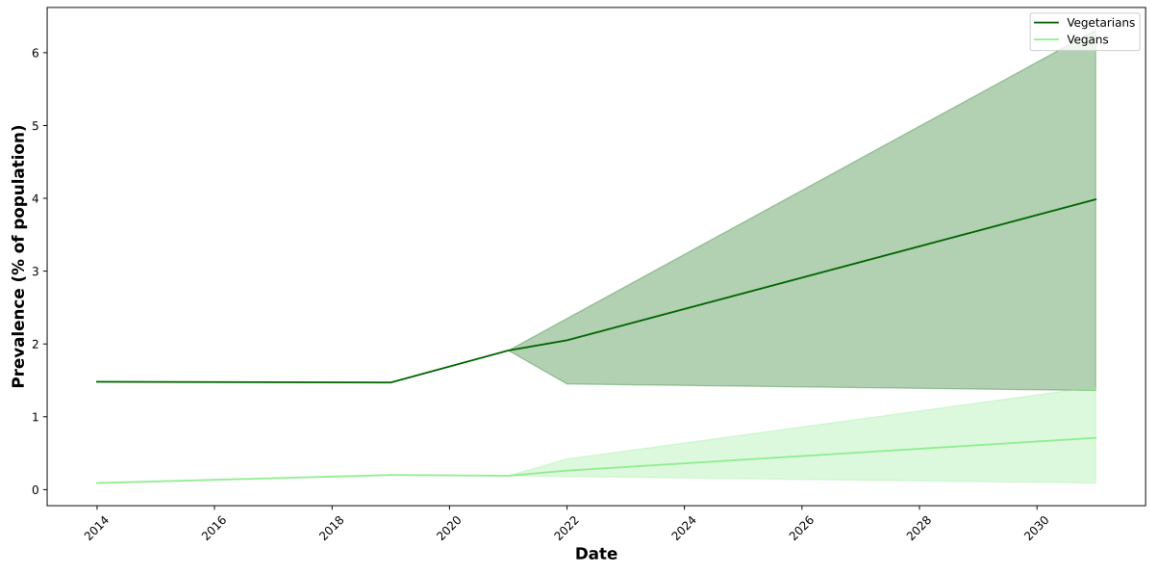
Figure 5. A, prevalence of care homes across the UK housing '*at least*' one vegetarian (dark green) or one vegan resident (light green) in 2014, 2019 and 2024. Data presented for 2019 is annotated with a '*' to highlight the potential confounding effects of COVID-19 on care home residency. **B,** mean prevalence of vegan (light green) and vegetarian (dark green) dieters living per care home that was assessed in the surveys, across the UK in 2014, 2019 and 2024. Data presented for 2019 is annotated with a '*' to highlight the potential confounding effects of COVID-19 on care home residency.

The mean prevalence of vegetarian and vegan dieters living in care homes across the UK included in the analysis was 1.48 % in 2014 rising to 1.91 % in 2024 and 0.09 % in 2014 rising to 0.19 % in 2024 for vegetarians and vegans, respectively (Figure 5 B). The 2nd order polynomial regression analysis performed on the ONS-derived number of care home residents

aged 65+ years living across the UK, provided an estimate of 294,854 residents in the UK in 2014 which decreased to 265,005 by 2024 (Appendix 2). This considered, the mean prevalence of vegetarians living in care homes in 2014, estimated by Vegetarian for Life CATI data, (1.48 %) and 2024 (1.91 %) would therefore result in an estimated absolute prevalence of ~4,364 and ~5,035 vegetarian residents. The mean prevalence of vegans living in care homes across the UK in 2014 (0.09 %) and in 2024 (0.19 %) results in an estimated absolute prevalence of ~295 and ~504 vegan residents, respectively.

Linear regression analysis estimated future mean prevalence of vegetarians and vegans aged 65+ years old living in care homes to be ~3.99 % (1.36 – 6.31 %) and 0.71 % (0.09 – 1.41 %) by the year 2031, respectively (Figure 6). Estimated mean prevalence of vegetarians living in care homes across the UK (3.99 %) would therefore be an estimated increase to ~13,897 (4,733 – 21,978) vegetarian residents by the year 2031. For vegans, the estimated mean prevalence (0.71 %) would lead to an estimated ~2,473 (313 – 4,911) vegan residents by the year 2031.

Figure 6. The estimated mean prevalence of vegan (light green line and fan beam) and



vegetarian (dark green line and fan beam) living in care homes across the UK by the year 2031. The dark and light green shaded areas represent 90 % confidence intervals for the estimated mean prevalence of vegetarians and vegans living per care home that was included in the survey, respectively.

Discussion

Rationale for estimated forecasts

The aim of the current analysis was to perform a basic forecast estimating the potential growth in the number of plant-based dieters across the UK over the next decade and, in turn, the prevalence of older (65+ years) plant-based dieters living in care homes over a similar time period. The statistical analysis forecasted declines in the total number of meat eaters (-3.7 %), and vegetarians (-0.8 %) living in the 0UK by 2034, whereas the number of vegans were estimated to increase (+0.8 %). This would result in ~69.3 % of the UK population consuming meat, 4.2 % being vegetarian and 2.8 % being vegan by the year 2034. It should be noted that these values do not result in a total of 100 %, due to the prevalence of other dietary patterns that were included in the analysis, but for clarity not included in the figures of the current report- such as pescatarian and flexitarian diets. The number of care home residents aged 65+ years old living in the UK in 2014, via 2nd order polynomial regression, was estimated to be 294,854 residents compared to estimates in 2024 that declined to 265,005. It is noteworthy that this decline is, at least in part, due to COVID-19 that was implicated in 85,305 care home deaths during the first wave of the pandemic, rising to 99,380 deaths across the second wave [19]. Data collated on behalf of Vegetarian for Life estimated the mean prevalence of vegans and vegetarians living per care home to be ~0.09 % and 1.48 % in 2014 which increased to ~0.19 % and 1.91 % by 2024, respectively. When aligned with estimates of the number of care home residents aged 65+ years old in those data collection years, the absolute number of vegans was ~500 and vegetarians ~5,000 living in care homes in 2024. Finally, linear projections of the prevalence of plant-based dieters aged 65+ years old living in care homes in 2031 was ~0.7 % for vegans (~2,500 based on projected total care home residents) and ~3.99 % for vegetarians (~13,584 based on projected total care home residents).

It is an important finding that the prevalence of plant-based dieters is projected to increase across the UK over the next 10 years. As these diets become more widespread throughout society, they are likely to become more normalised among the general population [22] and in the media [23]. Trends that gather momentum as one event feeds back into itself grow via a phenomenon known as the snowball effect [24]. Whilst plant-based diets are often a deeply held philosophical belief and are therefore important to distinguish from a ‘trend’ per se, this is comparable to the way in which they may be expected to continue to rise in prevalence across the UK. According to research conducted across numerous other European nations, plant-based diets gain acceptance and an increased likelihood of adoption with greater awareness and knowledge among the general public [22]. This is clear when observing trends in plant-based food products, as more people adopt plant-based diets, or at least reduce their meat

consumption, the demand for plant-based food products is increased. The Smart Protein Project found that plant-based food sales across Europe grew by 73 %, worth €750 million, between 2018 and 2020 [25]. This supports the notion that vegan and vegetarian diets are becoming more normalised in society as their prevalence continues to rise, which will likely contribute to the predicted growth in prevalence over the next 10 years.

Regional analyses suggest that the prevalence of vegans and vegetarians living in London will rise to 3.0 % and 6.2 %, respectively. In addition, their prevalence is estimated to rise in the Midlands (vegans = ~4.0 %, vegetarians = ~6.8 %) and in Wales (vegans = ~10.9 %, vegetarians = ~11.0 %), whereas only vegans are estimated to rise in Northern England (vegans = ~3.4 %) and Scotland (vegans = ~5.5 %) by 2034. In Southern England, the prevalence of both plant-based diets is estimated to decline by 2034 (vegans = ~1.8 %, vegetarians = ~2.9 %). Currently it is unclear why the prevalence of plant-based diets was estimated to increase in some regions of the UK in the current analysis, but not in others. Whilst there is a paucity of empirical evidence to explain these projections, there may be some speculative theories that contextualise these statistical findings. They could be explained simply by the larger proportion of older individuals living in the South of England [26], who may be less likely to adopt a plant-based diet (than younger individuals), thus potentially resulting in reduced prevalence of vegans and vegetarians in these regions. The current analysis, however, estimated that the prevalence of these dietary patterns is set to increase in individuals aged over 65 years across the UK. It is also possible, for example, that certain regions of the UK, such as Northern England, Scotland and Wales have been the focus of recent government policy to improve dietary behaviour, that could result in a shift towards meat reduction and even adoption of plant-based diets. Indeed, evidence from 2001-2012 demonstrated that healthful food groups, such as fruits and vegetables, were consumed in significantly lower quantities, on average, in Scotland compared with England and this discrepancy was more pronounced in lower income groups [27]. Similar findings have been observed in Northern England and the inner London areas [28]. In 2022, the 'Good Food Nation (Scotland)' bill was passed by Scottish government, encouraging the provision and subsequent uptake of healthful foods like fruits and vegetables [29]. Whether this influenced the uptake of plant-based diets in Scotland is unclear, but it is logical to speculate that it may have encouraged a reduction in meat consumption and shifted public focus towards vegetarian and vegan dietary patterns.

Additional analyses of the total UK sample categorised by age range revealed estimates of moderate increases in the number of vegans aged 50-64 years old (+0.6 %), with little change

in the number of vegetarians (+0.1 %) whereas 65+ year olds were predicted to experience large increases in both vegans (+2.7 %) and vegetarians (+6.8 %) by 2034. This is of particular relevance for care homes as this age group form the majority of residents across the UK, currently up to ~82 %, meaning that it would be expected to result in more plant-based dieters moving into the care system. Indeed, the projections forecasted based on previous ONS data (on the total number of care residents aged 65+ years) combined with Vegetarian for Life data (on the mean prevalence of plant-based dieters living per UK care home) estimated that the prevalence of vegans and vegetarians could rise to ~2,500 (0.71 %) and ~13,900 (3.99 %) residents by the year 2031. Peer-reviewed scientific literature to support or explain these specific increases in care home residents is currently limited, however it has previously been shown that 'Boomers' (born before 1960) have consistently been low-level consumers of meat and meat products over time [30]. This means that individuals entering the care system over the next 10-15 years will come from a generation with a history of low meat consumption, regardless of the motivations that underpin their food choices. However, the magnitude of this increase in vegetarian residents (and for vegan data) from 2024 to 2031 in the present estimations is likely due to the forecasted increase in total care residents and the limited Vegetarian for Life data points (n=3 at present) resulting in an exaggerated increase across time. As the present estimates and others sources suggest that populations consuming plant-based diets are increasing, and given the limited data at present, a more realistic estimate (authors opinion) would be to use the 2014-2024 mean prevelance (Vegetarian for Life data) plus two standard deviation (+2 SD) above that mean (appendix 3). For example for vegetarians the mean of 1.72% + 0.44 (+2 SD) = 2.16% or a prediction of 7,523 vegetarian care home residents. Likewise for the vegans, the mean of 0.16% + 0.12 (+2 SD) = 0.38% or a prediction of 1,324 vegetarian care home residents.

Given the expectation that the number of plant-based dieters aged 65+ years are estimated to increase over the next decade, both among the general population and living in care homes, it is imperative that staff possess the knowledge to provide appropriate nutrition to support plant-based residents. Indeed, previous work has alluded to a lack of nutritional education among UK care home staff [5]. There are publicly available tools, such as the 'Good Care for Vegetarians and Vegans' devised by Vegetarian for Life and the Care Inspectorate [31], that provide a framework for care homes to ensure that appropriate considerations have been made regarding plant-based residents. To the authors' knowledge, this tool does not provide nutrition-specific information to guide care staff on appropriate food options for plant-based residents.

Given the findings of the current report, it is therefore recommended that either this tool be extended to incorporate nutrition advice, or a new tool be devised with specific focus on appropriate provision of macro- and micronutrients for plant-based care home residents. A lack of appropriate provisions for residents may result in an unbalanced plant-based diet, which could be particularly detrimental to the health of ageing populations [32]. This could cause potential adverse health risks associated with an unbalanced plant-based diet for older individuals, meaning care homes would need to develop strategies to negate/circumvent these risks. Importantly, as these dietary patterns become more widely adopted these risks become more relevant, particularly if appropriate nutritional education and subsequent support frameworks are not put in place. It might therefore be expected that the number of legal cases seeking protection of plant-based diets as a philosophical belief are likely to increase. This would be pertinent for companies, large organisations and service providers who may be required to make additional considerations for plant-based dieters, should there be a shift towards greater protection within a legal context.

Key macro- and micronutrients for care homes with plant-based residents to consider

Weight loss is common in ageing populations [33], often attributable to appetite suppression and the resultant declines in total energy intake [34]. This is a concern among both free-living [35] and institutionalised older individuals [36], which has been associated with cardiovascular disease-related mortality [37] and other age-related conditions such as sarcopenia [38]. These concerns could be exacerbated by following a poorly constructed plant-based diet. Reduced total energy intake is characteristic of plant-based diets, particularly vegan [39-43]. It is recommended that any plant-based dieters living in the care system should therefore look to consume more energy-dense foods such as nuts, seeds and their respective oils [44]. Vegetarians may also consider certain dairy products [44], and vegans their plant-based replacements [45], as well as meat-replacement products such as mycoproteins [46].

Following years of extensive research, dietitians now advise that older individuals consume dietary protein in greater amounts than younger populations (1.0-1.2 g/kg/d *vs.* 0.75 g/kg/d) to maintain skeletal muscle mass as they grow older [47]. This is due to a phenomenon known as anabolic resistance, in which stimuli that promote gains in skeletal muscle mass via protein synthesis become less effective with age [48]. This reduced capacity to stimulate the protein synthetic response has been associated with age-related conditions such as sarcopenia, the prevalence of which has been estimated between 10-40 % in community-dwelling populations

[49]. There is little evidence and therefore it is still debated whether plant-based diets could compromise skeletal muscle health because of any potentially inadequate protein intake or if there could be a positive impact from years of consuming a habitual plant-based diet. Indeed, both vegetarian and vegan dieters have previously been shown to consume less dietary protein on a daily basis compared to meat eaters, although still beyond recommended intakes in the UK [40]. It should be additionally noted that the mean intakes observed in these existing studies would not satisfy the more recently updated targets for older individuals [47] and that these data were generated from a time with less abundant alternatives to animal-based protein sources (e.g. 1990-2010) ([25]. It may also be argued that there are additional concerns related to the quality of plant-based protein sources, outlined in more details elsewhere [50]. Those that argue this, suggest that plant-based dieters should consume a higher daily protein intake than meat eaters to account for the discrepancy in protein quality. It is often counterpointed, however, that eating a variety of protein sources should provide a natural mixture of essential amino acids that would overcome any potential issues with protein quality [50]. Indeed, evidence consistently shows that skeletal muscle mass and function is not compromised in groups of vegan and vegetarian dieters [51-53], however less is currently known about those in older individuals and those living in care homes. It is recommended that future research investigates how plant-based diets affect skeletal muscle health in care home populations.

Dietary calcium intake is recommended to be ~700 mg/d in the UK [54], with other nutritional guidelines suggesting that older adults should consume upwards of ~1200 mg/d [55, 56]. Research has shown that at least 30 % of community-dwelling older adults may consume less than 1000 mg/d of calcium [57]. This could, in part, help to explain the deterioration in bone mineral density (BMD) that is typically observed in older adults that can result in diagnosis with age-related diseases such as osteopenia and osteoporosis [58]. Greater BMD is associated with a reduced risk of fracture [59, 60], meaning that older individuals may be at a greater risk of suffering a fracture- particularly if their dietary calcium intake in inadequate. Historically, vegans (but not vegetarians) have consumed less dietary calcium than those that regularly consume meat and dairy products [40]. More recently, the increase in availability of fortified plant-based food products should allow for more simplistic achievement of dietary intake recommendations for vegan dieters. Both soy and almond milk alternatives, for example, can match or even surpass bovine milks for calcium content [45]. Leafy green vegetables are also recommended sources of dietary calcium with specific targeting of certain Chinese greens such as cabbage flower leaves, mustard greens and spinach that possess a very high calcium content

[61]. The fact that plant-based dieters may find calcium more readily available in a more modern dietary pattern than before may be supported by evidence suggesting that BMD was often reported to be lower in vegans compared to meat eaters, but more recent evidence seems to suggest this is no longer the case. For example, meta-analytical work that incorporates multiple older studies has previously observed lower BMD in vegan dieters [62], however more recent (albeit independent) studies suggest that the differences may no longer exist [63]. This is a prime example of how educational packages that explain the potential importance of plant-based dairy alternatives (or whole foods sources of dietary calcium) might be important for care home staff.

Bone health also relies on vitamin D, from both dietary sources such as oily fish and from direct exposure to ultraviolet B irradiated sunlight [64]. Whilst sunlight exposure is the most prolific method of attaining vitamin D (10,000-25,000 IU from exposure between 10:00-15:00) [65], it is recommended that adults in the UK consume 400 IU/d (or 10 µg/d) from dietary sources [66]. Concerns have been raised in previous literature, suggesting that adults aged 65+ in the UK consume, on average, ~3.85 µg/d and ~2.76 µg/d, in males and females, respectively [67]. Both vegans and vegetarians have previously been shown to consume ~1.97 µg/d and ~1.77 µg/d, respetively suggesting that inadequate intakes of vitamin D are perhaps prominent across the UK, regardless of dietary pattern [40]. This means that for both plant-based dieters and meat eaters living in UK care homes, time spent outdoors for midday sunlight exposure and greater consumption of dietary vitamin D sources is imperative for healthy ageing. Oily fish, red meats and eggs should be targeted for meat eaters, whereas fortified alternatives to dairy and meat are likely the best option for plant-based dieters. This is particularly the case owing to the lower vitamin D content of most plants [68] combined with a high content of antinutritonal factors such as tannins and phytates that, despite eliciting a variety of health benefits [69], are associated with blunted absorption of important nutrients such as vitamin D [70]. This considered, if required additional supplementation with ~800 IU/d of cholecalciferol would also likely be beneficial for care home residents [71].

Whilst there are some legitimate concerns regarding certain nutrients for those following an unbalanced plant-based diet, many nutrition and dietetics societies have published consensus statements outlining their feasibility for healthy living, with some extending their support across the adult lifespan, including in older populations [72, 73]. There are also numerous peer-reviewed articles discussing health benefits associated with a balanced plant-based dietary pattern [74]. For example, there is considerable evidence, including meta-analytical work, to

suggest that long-term adoption of a plant-based diet may reduce the risk of cardiovascular disease incidence and mortality [75-77]. Specifically, there is evidence to suggest that both morbidity and mortality associated with ischaemic heart disease is lower in vegan and vegetarian dieters compared with meat eaters [78]. There is also evidence to suggest that adoption of a plant-based diet may reduce the relative risk of type II diabetes by ~18 % compared with meat eaters [79], as well as facilitate the management of symptoms such as help reduce glycated haemoglobin (HbA1C) concentrations and improve insulin sensitivity [80, 81]. The risk of certain forms of cancer has been shown to be lower in plant-based dieters, including digestive system, pancreatic and prostate [79]. However, evidence is not conclusive with some studies demonstrating no beneficial effects of plant-based diets on both prostate and breast cancer diagnosis [82, 83]. Finally, there has been some speculation among peer-reviewed literature that plant-based diets may be associated with reduced risk of dementia and Alzheimer's disease in ageing populations [84], however there is yet to be any empirical evidence to support this, with one previous study finding no beneficial effects of *adherence* (i.e. not habitual adoption of diet) to a plant-based diet on cognitive function [85].

Forecasting limitations and future considerations

The data used for analysis in the current report were predominantly sourced from publicly available databases, such as YouGov and ONS. It is important to note that these datasets are limited to small sample sizes (YouGov: n = 10, ONS: n = 5 individual years), which is likely to influence the accuracy of the linear regression-derived projections. This is evident in the error that is present in the projected values, ranging between ~2.5-11.5 % in certain projections of plant-based diet prevalence across the UK (YouGov data) and reaching ~58 % in the projected number of care home residents aged 65+ years old (ONS data). Bootstrapping was performed for this reason, allowing for generation of 90 % confidence intervals that facilitate more cautious interpretation of the results. To the authors' knowledge, there is no existing published analyses that projects the prevalence of plant-based dieters living in care homes, hence the limited existing datasets and more simplistic statistical approaches in the current report. This reflects the existing scientific literature on plant-based diets in older populations. Currently, the majority of peer-reviewed research is focused on younger populations (<65 years old), meaning researchers and practitioners can only draw inference or speculate on most potential health effects of plant-based dieters in the older population. It is therefore recommended that future research aims to investigate the potential health benefits and/or

detriments of vegan and vegetarian diets in the older population, and in those living in care homes. Findings from these studies would better inform government policy related to the older population and allow for construction of dietary recommendations and guidelines to be implemented in care homes across the UK. Furthermore, it is also recommended that the current analysis be repeated multiple times over the next ten years, as datasets grow to become more complete improving the accuracy of the statistical projections.

Data collected via previously CATI data on behalf of Vegetarian for Life also had limited datapoints ($n = 3$). Indeed, it is difficult to perform accurate statistical projections on just three datapoints, as evidenced by the 90 % confidence intervals constructed using bootstrapping that reached ~5 % in the current analysis. It should also be noted that this data was not collected for the purposes of academic peer-reviewed publication, so therefore may lack a certain level of scientific rigour and specific study design. Despite this, it is a useful insight to use data specific to plant-based dieters currently living in care homes which provides an indication of a potential upward trend that can be, at least in part, explained by peer-reviewed literature (e.g. 'Boomers' being low meat consumers').

The data used for statistical projections of the number of care home residents across the UK was specific to the over 65-year-old population. This means that these projected values, as well as the absolute estimates of plant-based dieters living in care homes, will have been underestimated in the current analysis. According to 'Carehome.co.uk', there were 11,639 care homes for the older population in 2023, yet there were 6,019 homes for learning disabilities and 9,753 dementia-specific homes [86]. This means that the total number of care home residents estimated in the current analysis will have been underestimated in the current analysis, as individuals with learning disabilities or dementia that are under the age of 65 years were not accounted for. It was estimated (by combining various sources) that the total number of care home residents across the UK in 2023 was 441,479 (372,035 in England as determined by the ONS) [87], thus indicating the potential discrepancy between the ONS data used and the actual number of care home residents in the UK. The ONS data was chosen as it was, to the authors' knowledge, the best publicly available data source that provided information over time (as opposed to short snapshots at a single timepoint as seen in other data sources). The use of census data also guarantees a large sample size therefore estimates at each timepoint should be an accurate reflection of the number of care residents. On the other hand, as the census is completed once every ten years there were minimal datapoints to incorporate into the current

analysis. There is also, to the authors' knowledge, no existing literature on the prevalence of religious beliefs in UK care homes over time and it was not possible, therefore, to include this in the current report. This is an important consideration for future research, given that the similarities often drawn between secular philosophical beliefs and those of a religious nature when discussing the legality of accommodating a plant-based lifestyle. Indeed, data on the prevalence of religious dieters living in care homes and discussion around policy to accommodate these beliefs would certainly support the movement encouraging better provisions for plant-based care residents in the care sector. This is a considerable gap in the academic literature that requires considerable effort to elucidate the impact of appropriate feeding options for religious residents, regardless of domination.

Conclusion

The findings of the current report estimate that the prevalence of plant-based dieters living across the UK is likely to increase over the next ten years, particularly in individuals of an age likely to require care home assistance (e.g. 65+ years old). Separate analyses showed an estimated increase in the total number of over 65s living in UK care homes, as well as the proportion of each care home (that was assessed in the Vegetarian for Life CATI data) following both vegetarian and vegan diets. It stands to reason that, with the current ageing population across the UK, the rise in popularity of plant-based diets, and the reduced meat consumption previously observed in the older demographic across the UK, that vegan and vegetarian dieters will likely become more prevalent in care homes in the future. It is also likely that this will come with an increase in the demand for provision of plant-based foods for care home residents, and potential for legal challenge from residents who believe that homes are not respecting their chosen dietary pattern, as a philosophical belief. It is recommended that nutrition-specific educational packages be devised and distributed to care homes across the UK, to ensure that care staff are aware of the nutritional requirements of older individuals and how adoption of a plant-based diet may (or may not, contrary to certain widespread beliefs) venture from these traditional requirements.

Practical recommendations

These practical recommendations are to be considered with appropriate caution given the currently available data and literature. Fundamentally, considerably more research/data is needed in all aspects of this important field of study (plant-based dieters in the care sector) for confident recommendations to be made.

- Care homes across the UK should prepare for the potential rise in plant-based dieters across the general population that may enter the care sector in the coming years, particularly from the 'Boomer' generation.
- The potential of legal challenge on the bases of poor accommodations should also be considered as there has been some success via the Equality Act 2010. Further, the Mental Capacity Act 2005, which may be used as the basis for further challenge, has yet to be employed int this fashion but could be an additional justification for a potential challenge.
- Given the existing knowledge on the difficulties in providing adequate nutrition for older persons (energy deficiency, anabolic resistance, vitamin and mineral inadequacies etc.), care homes need to be more mindful when feeding and not discriminate against plant-based dieters. This is due to the existence of evidence from younger populations, however currently there is limited knowledge on habitual plant-based dieters and it is possible that they may exacerbate existing inadequate with poorly planned plant-based food options.
- Significantly more research is needed to elucidate the experiences and health of habitual plant-based dieters living in the UK care sector. Non-peer reviewed anecdotes suggests that some resident may have experienced specific and targeted discrimination, but this claim needs to be confirmed and further studied though rigorous experimental design. If found to be an accurate reflection of current conditions, considerable policy change is needed immediately and appropriate investigations leading to considerable ramifications need to be brought against accountable parties.

    Further, there is very little knowledge on the health status and nutritional intake of plant-based residents currently living in the care sector. Therefore, conjecture on their possible health and performance outcomes has little bases in the scientific evidence at present. Research urgently needs to address this gap in our evidence-based knowledge as if adequate and well-planned plant-based diets are more optimal for aging health outcomes, the sector could adopt more plant-based food choices across the general care home population. Or, if harmful to older populations the care sector, charitable organisations and individuals need to know in order to make informed decisions.

References

1. Office for National Statistics. *Voices of our ageing population: Living longer lives*. 2021; Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/ageing/articles/voicesofourageingpopulation/livinglongerlives.
2. Office for National Statistics. *Life expectancy in care homes, England and Wales: 2021 to 2022*. 2021; Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/articles/lifeexpectancyincarehomesenglandandwales/2021to2022#:~:text=1.,years%20and%20over%20for%20males.
3. Oliver, D., C. Foot, and R. Humphries, *Making our health and care systems fit for an ageing population*. 2014: Citeseer.
4. van Staveren, W.A. and L.P. de Groot, *Evidence-based dietary guidance and the role of dairy products for appropriate nutrition in the elderly.* Journal of the American College of Nutrition, 2011. **30**(sup5): p. 429S-437S.
5. Merrell, J., et al., *Addressing the nutritional needs of older people in residential care homes.* Health & Social Care in the Community, 2012. **20**(2): p. 208-215.
6. North, M., et al., *A qualitative examination of the motivations behind vegan, vegetarian, and omnivore diets in an Australian population.* Appetite, 2021. **167**: p. 105614.
7. All-Party Parliamentary Group on Vegetarianism and Veganism, *Respect for religious and philosophical beliefs while eating in care*. 2021.
8. Strumos, L., *Ethical veganism as nonreligion in Mr J Casamitjana Costa v the League against cruel sports.* Studies in Religion/Sciences Religieuses, 2022. **51**(3): p. 295-313.
9. Cranmer, F. and R. Sandberg, *A critique of the decision in Conisbee that vegetarianism is not 'a belief'.* Ecclesiastical Law Journal, 2020. **22**(1): p. 36-48.
10. UN General Assembly, *Universal Declaration of Human Rights*. 1948.
11. O'Sullivan García, M. *Vegetarian and vegan rights in Europe: chickening out or egging them on?* in *dA Derecho Animal: Forum of Animal Law Studies*. 2020.
12. *Mental Capacity Act*. 2005.
13. Phillips, F., *Vegetarian nutrition.* Nutrition Bulletin, 2005. **30**(2): p. 132-167.
14. The Vegan Society. *"How Many Vegans?"*. 2019.
15. Alae-Carew, C., et al., *The role of plant-based alternative foods in sustainable and healthy food systems: Consumption trends in the UK.* Science of the Total Environment, 2022. **807**: p. 151041.
16. YouGov. *Dietary choices of Brits (e.g. vegetarian, flexitarian, meat-eaters etc)?* 2024; Available from: https://yougov.co.uk/topics/society/trackers/dietery-choices-of-brits-eg-vegeterian-flexitarian-meat-eater-etc
17. Office for National Statistics. *Older people living in care homes in 2021 and changes since 2011*. 2023; Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/ageing/articles/olderpeoplelivingincarehomesin2021andchangessince2011/2023-10-09.
18. Arvanitakis, M., et al., *Nutrition in care homes and home care: recommendations–a summary based on the report approved by the Council of Europe.* Clinical nutrition, 2009. **28**(5): p. 492-496.
19. Office for National Statistics. *Deaths involving COVID-19 in the care sector, England and Wales: deaths registered between week ending 20 March 2020 and week ending 21 January 2022*. 2022 [cited 2024 01/08]; Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/deathsinvolvingcovid19inthecaresectorenglandandwales/deathsregisteredbetweenweekending20march2020andweekending21january2022#deaths-involving-coronavirus-covid-19-among-care-home-residents-in-england.
20. YouGov, *Dietary choices of Brits (e.g. vegetarian, flexitarian, meat-eater etc)?* 2024.

21. Statistics, O.f.N. *Voices of our ageing population: Living longer lives*. 2021; Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/ageing/articles/voicesofourageingpopulation/livinglongerlives.
22. Faber, I., et al., *Attitudes and knowledge towards plant-based diets of young adults across four European countries. Exploratory survey.* Appetite, 2020. **145**: p. 104498.
23. Boardman, A., *The Plant-Based Shift: Supporting or Undermining Veganism? A Content and Framing Analysis of UK Newspaper Coverage of Veganism and Plant-Based Diets.* A Content and Framing Analysis of UK Newspaper Coverage of Veganism and Plant-Based Diets (September 20, 2022), 2022.
24. Green, D.G. and D.G. Green, *The Snowball Effect.* Of Ants and Men: The Unexpected Side Effects of Complexity in Society, 2014: p. 103-115.
25. The Smart Protein Project, *Plant-based foods in Europe: How big is the market?* 2020.
26. Office for National Statistics. *Population and household estimates, England and Wales: Census 2021*. 2022; Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/populationandhouseholdestimatesenglandandwales/census2021.
27. Barton, K.L., et al., *Time to address the double inequality of differences in dietary intake between Scotland and England.* British Journal of Nutrition, 2018. **120**(2): p. 220-226.
28. Smith, D.M., et al., *Adult diet in England: Where is more support needed to achieve dietary recommendations?* Plos one, 2021. **16**(6): p. e0252877.
29. Scottish Parliament, *Good Food Nation (Scotland)*. 2022.
30. Stewart, C., et al., *Trends in UK meat consumption: analysis of data from years 1–11 (2008–09 to 2018–19) of the National Diet and Nutrition Survey rolling programme.* The Lancet Planetary Health, 2021. **5**(10): p. e699-e708.
31. Vegetarian for Life, C.I. *Good care for vegetarians and vegans*. Self-evaluation tool and guidance for care services and inspectors looking at quality indicator 1.3: People's health benefits from their care and support 2023; Available from: https://vegetarianforlife.org.uk/files/Good_care_for_vegetarians_and_vegans_self-eval_tool.pdf.
32. Domić, J., et al., *Perspective: vegan diets for older adults? A perspective on the potential impact on muscle mass and strength.* Advances in nutrition, 2022. **13**(3): p. 712-725.
33. Miller, S.L. and R.R. Wolfe, *The danger of weight loss in the elderly.* The Journal of Nutrition Health and Aging, 2008. **12**: p. 487-491.
34. Giezenaar, C., et al., *Ageing is associated with decreases in appetite and energy intake—a meta-analysis in healthy adults.* Nutrients, 2016. **8**(1): p. 28.
35. Engelheart, S. and G. Akner, *Dietary intake of energy, nutrients and water in elderly people living at home or in nursing home.* The journal of nutrition, health & aging, 2015. **19**: p. 265-272.
36. Murphy, J., J. Holmes, and C. Brooks, *Measurements of daily energy intake and total energy expenditure in people with dementia in care homes: The use of wearable technology.* The Journal of nutrition, health and aging, 2017. **21**(8): p. 927-932.
37. Lee, P.H. and C.-W. Chan, *Energy intake, energy required and mortality in an older population.* Public Health Nutrition, 2016. **19**(17): p. 3178-3184.
38. Okamura, T., et al., *Shortage of energy intake rather than protein intake is associated with sarcopenia in elderly patients with type 2 diabetes: A cross-sectional study of the KAMOGAWA-DM cohort.* Journal of diabetes, 2019. **11**(6): p. 477-483.
39. Davey, G.K., et al., *EPIC–Oxford: lifestyle characteristics and nutrient intakes in a cohort of 33 883 meat-eaters and 31 546 non meat-eaters in the UK.* Public health nutrition, 2003. **6**(3): p. 259-268.
40. Sobiecki, J.G., et al., *High compliance with dietary recommendations in a cohort of meat eaters, fish eaters, vegetarians, and vegans: results from the European Prospective Investigation into Cancer and Nutrition–Oxford study.* Nutrition Research, 2016. **36**(5): p. 464-477.
41. Waldmann, A., et al., *Dietary intakes and lifestyle factors of a vegan population in Germany: results from the German Vegan Study.* European journal of clinical nutrition, 2003. **57**(8): p. 947-955.

42. Dawczynski, C., et al., *Nutrient intake and nutrition status in vegetarians and vegans in comparison to omnivores-the Nutritional Evaluation (NuEva) Study.* Frontiers in nutrition, 2022. **9**: p. 819106.
43. Allès, B., et al., *Comparison of sociodemographic and nutritional characteristics between self-reported vegetarians, vegans, and meat-eaters from the NutriNet-Santé study.* Nutrients, 2017. **9**(9): p. 1023.
44. Drewnowski, A., et al., *Dietary energy density and body weight: is there a relationship?* Nutrition reviews, 2004. **62**(11): p. 403-413.
45. Chalupa-Krebzdak, S., C.J. Long, and B.M. Bohrer, *Nutrient density and nutritional value of milk and plant-based milk alternatives.* International dairy journal, 2018. **87**: p. 84-92.
46. Costa-Catala, J., et al., *Comparative assessment of the nutritional profile of meat products and their plant-based analogues.* Nutrients, 2023. **15**(12): p. 2807.
47. Bauer, J., et al., *Evidence-based recommendations for optimal dietary protein intake in older people: a position paper from the PROT-AGE Study Group.* Journal of the american Medical Directors association, 2013. **14**(8): p. 542-559.
48. Aragon, A.A., K.D. Tipton, and B.J. Schoenfeld, *Age-related muscle anabolic resistance: inevitable or preventable?* Nutrition reviews, 2023. **81**(4): p. 441-454.
49. Haran, P.H., D.A. Rivas, and R.A. Fielding, *Role and potential mechanisms of anabolic resistance in sarcopenia.* Journal of cachexia, sarcopenia and muscle, 2012. **3**: p. 157-162.
50. Pinckaers, P.J., et al., *The anabolic response to plant-based protein ingestion.* Sports Medicine, 2021. **51**(Suppl 1): p. 59-74.
51. Page, J., R.M. Erskine, and N.D. Hopkins, *Skeletal muscle properties and vascular function do not differ between healthy, young vegan and omnivorous men.* European Journal of Sport Science, 2022. **22**(4): p. 559-568.
52. Boutros, G.H., et al., *Is a vegan diet detrimental to endurance and muscle strength?* European journal of clinical nutrition, 2020. **74**(11): p. 1550-1555.
53. Hevia-Larraín, V., et al., *High-protein plant-based diet versus a protein-matched omnivorous diet to support resistance training adaptations: a comparison between habitual vegans and omnivores.* Sports Medicine, 2021. **51**: p. 1317-1330.
54. Nutrition, S.A.C.o., *Dietary reference values for energy*. 2012: The Stationery Office.
55. Yates, A.A., S.A. Schlicker, and C.W. Suitor, *Dietary reference intakes: the new basis for recommendations for calcium and related nutrients, B vitamins, and choline.* Journal of the American Dietetic Association, 1998. **98**(6): p. 699-706.
56. Joint, F., *Human vitamin and mineral requirements.* 2002.
57. ter Borg, S., et al., *Micronutrient intakes and potential inadequacies of community-dwelling older adults: a systematic review.* British Journal of Nutrition, 2015. **113**(8): p. 1195-1206.
58. Blake, G.M. and I. Fogelman, *The role of DXA bone density scans in the diagnosis and treatment of osteoporosis.* Postgraduate medical journal, 2007. **83**(982): p. 509-517.
59. Johnell, O., et al., *Risk factors for hip fracture in European women: the MEDOS study.* Journal of Bone and Mineral Research, 1995. **10**(11): p. 1802-1815.
60. Cummings, S.R., et al., *Bone density at various sites for prediction of hip fractures.* The Lancet, 1993. **341**(8837): p. 72-75.
61. Weaver, C.M., W.R. Proulx, and R. Heaney, *Choices for achieving adequate dietary calcium with a vegetarian diet.* The American journal of clinical nutrition, 1999. **70**(3): p. 543S-548S.
62. Iguacel, I., et al., *Veganism, vegetarianism, bone mineral density, and fracture risk: a systematic review and meta-analysis.* Nutrition reviews, 2019. **77**(1): p. 1-18.
63. Kim, M.-H., M.-K. Choi, and C.-J. Sung, *Bone mineral density of Korean postmenopausal women is similar between vegetarians and nonvegetarians.* Nutrition research, 2007. **27**(10): p. 612-617.
64. Benedik, E., *Sources of vitamin D for humans.* International Journal for Vitamin and Nutrition Research, 2021.
65. Nair, R. and A. Maseeh, *Vitamin D: The "sunshine" vitamin.* Journal of pharmacology and pharmacotherapeutics, 2012. **3**(2): p. 118-126.
66. Department of Health, *Dietary Reference Values: A Guide*. 1991.

67. Calame, W., L. Street, and T. Hulshof, *Vitamin D serum levels in the UK population, including a mathematical approach to evaluate the impact of vitamin D fortified ready-to-eat breakfast cereals: application of the NDNS database.* Nutrients, 2020. **12**(6): p. 1868.
68. Jäpelt, R.B. and J. Jakobsen, *Vitamin D in plants: a review of occurrence, analysis, and biosynthesis.* Frontiers in plant science, 2013. **4**: p. 136.
69. Gemede, H.F. and N. Ratta, *Antinutritional factors in plant foods: Potential health benefits and adverse effects.* International journal of nutrition and food sciences, 2014. **3**(4): p. 284-289.
70. Thakur, N. and P. Kumar, *Anti-nutritional factors, their adverse effects and need for adequate processing to reduce them in food.* AgricINTERNATIONAL, 2017. **4**(1): p. 56-60.
71. Poole, C.D., J.C. Smith, and J.S. Davies, *The short-term impact of vitamin D-based hip fracture prevention in older adults in the United Kingdom.* Journal of endocrinological investigation, 2014. **37**: p. 811-817.
72. British Dietetics Association. *Vegetarian, vegan and plant-based diets*. 2021.
73. Melina, V., W. Craig, and S. Levin, *Position of the academy of nutrition and dietetics: vegetarian diets.* Journal of the Academy of Nutrition and Dietetics, 2016. **116**(12): p. 1970-1980.
74. Key, T.J., K. Papier, and T.Y. Tong, *Plant-based diets and long-term health: findings from the EPIC-Oxford study.* Proceedings of the Nutrition Society, 2022. **81**(2): p. 190-198.
75. Kim, H., et al., *Plant-based diets are associated with a lower risk of incident cardiovascular disease, cardiovascular disease mortality, and all-cause mortality in a general population of middle-aged adults.* Journal of the American Heart Association, 2019. **8**(16): p. e012865.
76. Dinu, M., et al., *Vegetarian, vegan diets and multiple health outcomes: A systematic review with meta-analysis of observational studies.* Critical reviews in food science and nutrition, 2017. **57**(17): p. 3640-3649.
77. Dybvik, J.S., M. Svendsen, and D. Aune, *Vegetarian and vegan diets and the risk of cardiovascular disease, ischemic heart disease and stroke: a systematic review and meta-analysis of prospective cohort studies.* European journal of nutrition, 2023. **62**(1): p. 51-69.
78. Tong, T.Y., et al., *Risks of ischaemic heart disease and stroke in meat eaters, fish eaters, and vegetarians over 18 years of follow-up: results from the prospective EPIC-Oxford study.* bmj, 2019. **366**.
79. Wang, Y., et al., *Associations between plant-based dietary patterns and risks of type 2 diabetes, cardiovascular disease, cancer, and mortality–a systematic review and meta-analysis.* Nutrition journal, 2023. **22**(1): p. 46.
80. Barnard, N.D., et al., *The effects of a low-fat, plant-based dietary intervention on body weight, metabolism, and insulin sensitivity.* The American journal of medicine, 2005. **118**(9): p. 991-997.
81. Barnard, N.D., et al., *A low-fat vegan diet and a conventional diabetes diet in the treatment of type 2 diabetes: a randomized, controlled, 74-wk clinical trial.* The American journal of clinical nutrition, 2009. **89**(5): p. 1588S-1596S.
82. Kane-Diallo, A., et al., *Association between a pro plant-based dietary score and cancer risk in the prospective N utri N et-santé cohort.* International Journal of Cancer, 2018. **143**(9): p. 2168-2176.
83. Gilsing, A.M., et al., *Vegetarianism, low meat consumption and the risk of lung, postmenopausal breast and prostate cancer in a population-based cohort study.* European journal of clinical nutrition, 2016. **70**(6): p. 723-729.
84. Katonova, A., et al., *Effect of a vegan diet on Alzheimer's disease.* International journal of molecular sciences, 2022. **23**(23): p. 14924.
85. Van Soest, A.P., et al., *The association between adherence to a plant-based diet and cognitive ageing.* European Journal of Nutrition, 2023. **62**(5): p. 2053-2062.
86. carehome.co.uk. *Care home stats: number of settingsy, population & workforce*. 2024; Available from: https://www.carehome.co.uk/advice/care-home-stats-number-of-settings-population-workforce.
87. Office for National Statistics. *Care homes and estimating the self-funding population, England: 2022 to 2023*. 2023; Available from:

https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/socialcare/articles/carehomesandestimatingtheselffundingpopulationengland/2022to2023#overview.

Appendices

Appendix 1. YouGov data outlining the prevalence of dietary patterns across adults in the UK, by biological sex, age group and geographical region.

	Meat eaters									
	July 2019	**Jan 2020**	**July 2020**	**Jan 2021**	**July 2021**	**Jan 2022**	**July 2022**	**Jan 2023**	**July 2023**	**Jan 2024**
All adults	73 %	72 %	72 %	73 %	68 %	70 %	70 %	71 %	72 %	73 %
Males	78 %	77 %	76 %	78 %	72 %	77 %	75 %	78 %	79 %	77 %
Females	69 %	67 %	69 %	70 %	64 %	63 %	66 %	65 %	64 %	69 %
18-24 years	67 %	62 %	60 %	65 %	55 %	52 %	62 %	68 %	76 %	64 %
25-49 years	73 %	68 %	72 %	73 %	66 %	68 %	67 %	68 %	69 %	70 %
50-64 years	75 %	77 %	73 %	77 %	71 %	73 %	72 %	78 %	72 %	80 %
65+ years	75 %	77 %	78 %	75 %	75 %	78 %	78 %	73 %	74 %	74 %
London	70 %	62 %	66 %	68 %	60 %	64 %	64 %	61 %	63 %	67 %
Rest of south	71 %	70 %	70 %	73 %	66 %	71 %	72 %	72 %	71 %	73 %
Midlands	82 %	74 %	74 %	75 %	68 %	68 %	70 %	75 %	74 %	71 %
North	74 %	76 %	76 %	75 %	74 %	72 %	72 %	72 %	75 %	77 %
Scotland	73 %	79 %	75 %	76 %	68 %	67 %	68 %	72 %	74 %	71 %
Wales	71 %	76 %	76 %	73 %	75 %	78 %	72 %	77 %	68 %	78 %
	Flexitarians									
	July 2019	**Jan 2020**	**July 2020**	**Jan 2021**	**July 2021**	**Jan 2022**	**July 2022**	**Jan 2023**	**July 2023**	**Jan 2024**
All adults	13 %	15 %	13 %	14 %	14 %	16 %	16 %	14 %	14 %	13 %
Males	9 %	13 %	11 %	11 %	11 %	11 %	13 %	9 %	11 %	11 %
Females	16 %	17 %	16 %	16 %	17 %	20 %	19 %	19 %	18 %	15 %
18-24 years	11 %	17 %	13 %	13 %	11 %	20 %	14 %	11 %	8 %	13 %
25-49 years	12 %	16 %	12 %	13 %	15 %	16 %	18 %	14 %	15 %	14 %
50-64 years	12 %	14 %	14 %	14 %	16 %	14 %	16 %	13 %	16 %	9 %

65+ years	16 %	15 %	15 %	15 %	13 %	13 %	13 %	18 %	15 %	14 %
London	14 %	23 %	15 %	18 %	13 %	18 %	20 %	19 %	18 %	17 %
Rest of south	15 %	16 %	14 %	13 %	18 %	16 %	16 %	14 %	15 %	13 %
Midlands	9 %	13 %	14 %	13 %	12 %	16 %	15 %	14 %	13 %	13 %
North	13 %	13 %	12 %	13 %	12 %	14 %	14 %	13 %	12 %	11 %
Scotland	10 %	12 %	12 %	10 %	12 %	14 %	18 %	15 %	15 %	12 %
Wales	13 %	14 %	10 %	19 %	15 %	15 %	14 %	11 %	12 %	11 %

Pescatarians

	July 2019	**Jan 2020**	**July 2020**	**Jan 2021**	**July 2021**	**Jan 2022**	**July 2022**	**Jan 2023**	**July 2023**	**Jan 2024**
All adults	3 %	2 %	3 %	3 %	3 %	3 %	3 %	3 %	3 %	3 %
Males	2 %	1 %	2 %	2 %	3 %	2 %	2 %	2 %	2 %	2 %
Females	4 %	3 %	3 %	4 %	3 %	4 %	4 %	3 %	4 %	5 %
18-24 years	1 %	2 %	3 %	5 %	5 %	4 %	1 %	3 %	3 %	2 %
25-49 years	3 %	2 %	3 %	3 %	3 %	3 %	3 %	3 %	3 %	3 %
50-64 years	3 %	3 %	2 %	2 %	2 %	2 %	4 %	2 %	3 %	4 %
65+ years	3 %	2 %	3 %	3 %	4 %	3 %	3 %	3 %	2 %	4 %
London	3 %	4 %	2 %	2 %	5 %	4 %	4 %	4 %	3 %	3 %
Rest of south	3 %	2 %	3 %	3 %	3 %	2 %	3 %	3 %	3 %	3 %
Midlands	3 %	2 %	2 %	3 %	3 %	5 %	4 %	3 %	2 %	4 %
North	3 %	1 %	3 %	3 %	2 %	3 %	2 %	2 %	2 %	3 %
Scotland	3 %	1 %	1 %	2 %	4 %	5 %	1 %	3 %	3 %	3 %
Wales	4 %	1 %	7 %	1 %	3 %	0 %	2 %	3 %	2 %	1 %

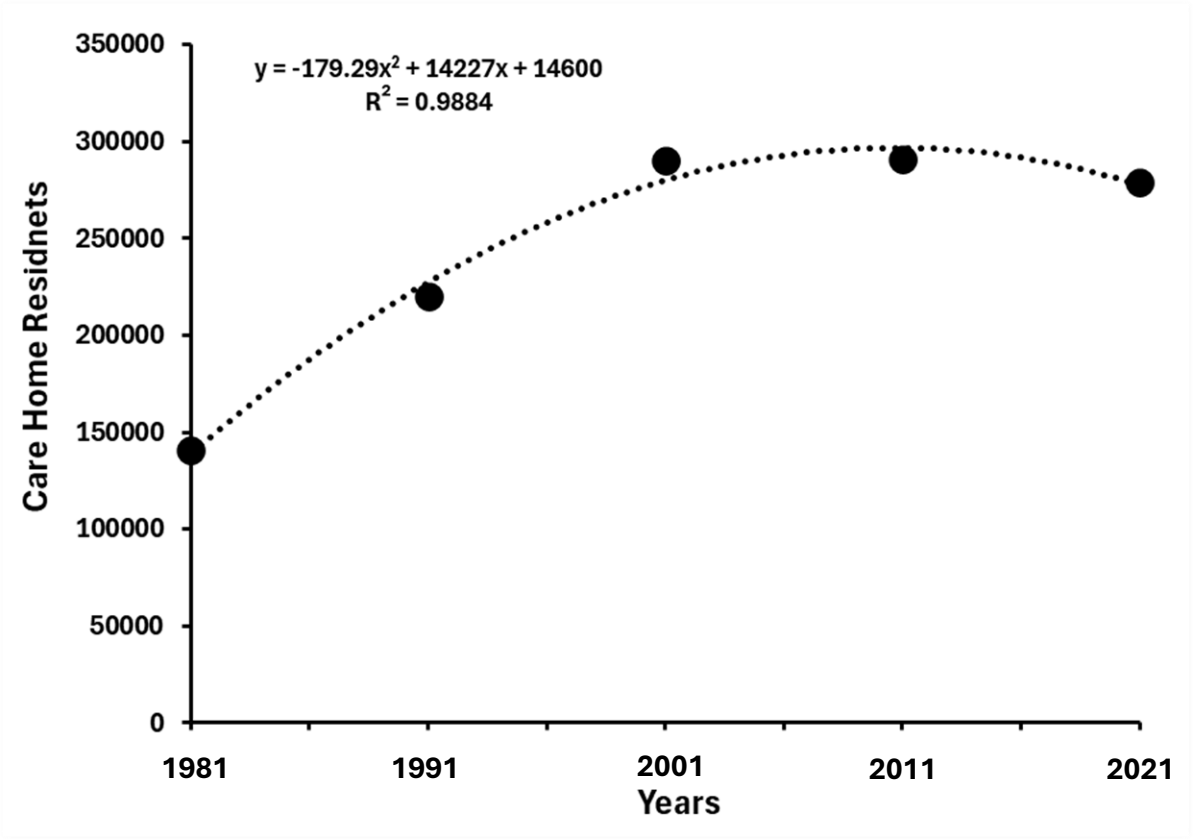
Vegetarians

	July 2019	**Jan 2020**	**July 2020**	**Jan 2021**	**July 2021**	**Jan 2022**	**July 2022**	**Jan 2023**	**July 2023**	**Jan 2024**
All adults	5 %	5 %	6 %	5 %	7 %	5 %	5 %	5 %	5 %	5 %
Males	4 %	3 %	4 %	5 %	6 %	3 %	4 %	3 %	2 %	4 %
Females	6 %	7 %	7 %	5 %	8 %	7 %	6 %	8 %	8 %	6 %

18-24 years	10 %	9 %	9 %	11 %	10 %	10 %	8 %	9 %	6 %	10 %
25-49 years	6 %	7 %	7 %	6 %	8 %	5 %	5 %	7 %	6 %	5 %
50-64 years	4 %	3 %	5 %	4 %	5 %	5 %	5 %	3 %	4 %	4 %
65+ years	2 %	2 %	2 %	2 %	5 %	3 %	3 %	3 %	4 %	4 %
London	6 %	5 %	7 %	9 %	10 %	7 %	4 %	7 %	7 %	6 %
Rest of south	5 %	6 %	5 %	5 %	6 %	5 %	5 %	5 %	4 %	5 %
Midlands	3 %	5 %	6 %	7 %	9 %	6 %	4 %	5 %	6 %	5 %
North	5 %	5 %	6 %	2 %	6 %	5 %	5 %	6 %	4 %	4 %
Scotland	6 %	6 %	5 %	5 %	5 %	3 %	6 %	5 %	5 %	3 %
Wales	5 %	5 %	4 %	4 %	4 %	3 %	6 %	3 %	11 %	5 %

Vegans

	July 2019	**Jan 2020**	**July 2020**	**Jan 2021**	**July 2021**	**Jan 2022**	**July 2022**	**Jan 2023**	**July 2023**	**Jan 2024**
All adults	2 %	2 %	2 %	2 %	3 %	2 %	2 %	3 %	2 %	2 %
Males	2 %	1 %	2 %	3 %	2 %	2 %	2 %	2 %	2 %	3 %
Females	2 %	2 %	2 %	2 %	4 %	3 %	3 %	3 %	2 %	2 %
18-24 years	7 %	5 %	7 %	2 %	9 %	5 %	4 %	3 %	1 %	4 %
25-49 years	3 %	2 %	2 %	2 %	4 %	2 %	4 %	5 %	3 %	3 %
50-64 years	2 %	1 %	2 %	2 %	2 %	3 %	1 %	2 %	2 %	2 %
65+ years	0 %	1 %	0 %	1 %	0 %	0 %	1 %	1 %	1 %	1 %
London	2 %	2 %	5 %	1 %	5 %	4 %	3 %	4 %	2 %	2 %
Rest of south	3 %	3 %	2 %	2 %	3 %	1 %	2 %	3 %	2 %	3 %
Midlands	2 %	1 %	1 %	1 %	1 %	3 %	3 %	1 %	2 %	2 %
North	2 %	1 %	1 %	3 %	4 %	3 %	2 %	2 %	2 %	2 %
Scotland	4 %	0 %	2 %	2 %	5 %	3 %	4 %	2 %	2 %	4 %
Wales	1 %	1 %	0 %	1 %	3 %	0 %	2 %	6 %	3 %	3 %



Appendix 2. The 2nd order polynomial regression performed on Office for National Statistics data collated via the census to determine the number of care home residents living in the UK every ten years.

Appendix 3. Vegetarian for Life survey data over time, presented as percentage of the total +65 years care home resident population across the UK.

Residents	Year			Mean	SD
	2014	***2019***	***2024***		
Vegetarian (%)	1.48	1.47	1.19	1.72	0.22
Vegan (%)	0.09	0.20	0.19	0.16	0.06

SD, standard deviation.

Appendix 4. Conservative estimates for the potential population of plant-based dieters across the UK care sector by 2031 using mean percentage prevalence (appendix 3) and estimated +65 years care home resident population based on linear regression (appendix 2).

Residents	Calculated from mean %	Calculated from mean % + 2 SDs
Vegetarian (est.)	5,591	7,523
Vegan (est.)	557	1,324
Total plant-based dieters (est.)	6,148	8,847

est, estimated population size; SD, standard deviations.