



Article

What Are the Barriers to Adoption of a Lifestyle Associated with Optimal Peak Bone Mass Acquisition? A Qualitative Study of Young Adults in New Zealand

Sana Zafar ¹, Hayley Denison ², Hansa Patel ¹ and Elaine Dennison ^{1,3,*}

- ¹ School of Biological Sciences, Victoria University of Wellington, Kelburn, Wellington 6012, New Zealand; sanazafar911@gmail.com (S.Z.); Hansa.patel@vuw.ac.nz (H.P.)
- ² Centre for Public Health Research, Wellington Campus, Massey University, Wellington 6140, New Zealand; H.Denison@massey.ac.nz
- ³ MRC Lifecourse Epidemiology Centre, University of Southampton, Southampton SO16 6YD, UK
- * Correspondence: emd@mrc.soton.ac.uk or elaine.dennison@vuw.ac.nz

Abstract: Objective: This study aimed to investigate the barriers to adopting lifestyle factors other than physical activity important for optimal peak bone mass (PBM) acquisition—namely, dietary factors, avoidance of cigarette smoking, and keeping alcohol consumption within recommended limits. Materials and Methods: University students and staff aged 18–35 years were recruited. Six semi-structured, in-depth focus group interviews were conducted with a total of 28 participants. The interviews were digitally recorded and transcribed. A thematic approach for data analysis using a constant comparative method was performed using NVivo software. Results: Three major themes emerged: socio-cultural barriers (peer pressure and cultural norms); personal barriers (time, cost, and diet preferences); and other barriers (medical illness and lack of symptoms associated with low bone mass density). Conclusions: We identified several barriers to adoption of lifestyle behaviours that might be beneficial to PBM acquisition. These data might facilitate the development of public health interventions designed to help young adults embrace osteoprotective lifestyles, and hence reduce the burden of osteoporotic fracture in later life.

Keywords: peak; bone; lifestyle; qualitative; young adult



Citation: Zafar, S.; Denison, H.; Patel, H.; Dennison, E. What Are the Barriers to Adoption of a Lifestyle Associated with Optimal Peak Bone Mass Acquisition? A Qualitative Study of Young Adults in New Zealand. *Osteology* **2022**, *2*, 31–40. <https://doi.org/10.3390/osteology2010004>

Academic Editor:
Umile Giuseppe Longo

Received: 1 December 2021
Accepted: 1 February 2022
Published: 8 February 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Osteoporosis is a major public health problem through its association with fragility fracture in later life [1]. According to the Osteoporosis New Zealand (ONZ) annual report published in 2017 [2], more than 1.6 million New Zealanders are currently over the age of 50 years, and more than 180,000 New Zealand adults aged >50 years have sustained a fragility fracture. The same report suggests that every year in New Zealand almost 3700 people sustain a hip fracture, and almost 13,800 are admitted to hospital with other fractures [2]. Since it is estimated that the proportion of the New Zealand population over 50 will increase from 33% in 2015 to 38% in 2035, the prevalence of osteoporosis is set to increase still further [2]. Similarly, around 4.7 million Australians over 50 years of age have been reported to have osteoporosis, osteopenia, or poor bone health [3]. By 2022, it is estimated there will be 6.2 million Australians over the age of 50 with osteoporosis; a 31% increase from 2012 [3].

Fragility fracture carries with it very significant financial as well as personal burden; it was estimated that hip fractures cost the New Zealand Health system NZD 171 million in 2014 and the total costs including fragility fracture at all sites is likely to exceed NZD 300 million per year [2]. Osteoporosis Australia estimated the total costs of fragility fractures to be AUD 2.4 billion (USD 1.7 billion) in 2019, increasing to AUD 2.6 billion (USD 1.8 billion) by 2022 [3].

Peak bone mass (PBM) acquisition is a major determinant of later osteoporosis risk [4,5]. The period of most rapid skeletal development occurs in childhood and adolescence, which accounts for 30–40% of the total bone mass increase [6,7]. Lifestyle choices such as regular engagement with high impact weight bearing physical activity, adequate dietary calcium, and vitamin D intake along with avoidance of cigarette smoking and heavy alcohol consumption determine 40% to 60% of PBM of an individual [8–10]. However, it has been suggested that at this critical time of PBM acquisition, many young people are adopting sedentary lifestyles, smoking and drinking alcohol to excess, and following diets that may fail to attain recommended daily calcium intakes for this age group [11,12]. The reasons for these lifestyle choices have not previously been fully explored in studies in young adults.

One explanation may be lack of awareness or knowledge. Osteoporosis is traditionally considered a disease of older people, and many young adults may not be aware of factors that might impact their subsequent bone health. A study demonstrated that adolescents did not perceive themselves to be susceptible to osteoporosis, nor did they recognise it to be a serious condition, leading to poor osteoprotective practices [13]. A recent study by our own group also confirmed that there is limited understanding of bone health and PBM acquisition in young adults in New Zealand [14]. While educational interventions are warranted to improve awareness of osteoporosis among young adults, understanding the factors that encourage adoption of lifestyles associated with better bone health is helpful.

If young adults engage in lifestyles associated with better bone mineral density (BMD), this might reduce the burden of osteoporotic fracture in the future [15]. This approach is supported by previous research that suggests that self-efficacy is an important element of lifestyle choice; self-efficacy, social support, and participation in sports teams were strongly associated with bone health in adolescent girls [16], while other work has demonstrated self-efficacy to be a strong predictor of engaging in osteoporosis preventive behaviours [15,17,18].

There have been previous studies that investigated barriers to lifestyle choices associated with good bone health. These have identified years of education, knowledge of osteoporosis, social support, and social capital as being important [13,19–21], but very few studies investigated other lifestyle barriers in attaining optimal PBM in young adults, and this was the aim of this study. Prior to this work, the only New Zealand study that investigated knowledge and health belief regarding osteoporosis risk factors in young people was published over a decade ago [22]. The study found low perceived susceptibility of development of osteoporosis, with perceived barriers to exercise participation and eating calcium-rich foods. These findings were reaffirmed in a previous study by our own group [14] where we explored the barriers and facilitators to one factor important in PBM acquisition: recreational sporting activity [23]. In this paper we now focus specifically on the barriers to the other lifestyle factors important for PBM acquisition—namely, diet, cigarette smoking, and alcohol consumption, considering socio-cultural, personal, and other barriers that young adults face.

2. Materials and Methods

This research was conducted at Victoria University of Wellington, New Zealand. Six semi-structured focus group interviews were conducted between August 2018 and February 2019. Ethical approval for this study was granted by New Zealand Health and Disability Ethics Committee (Ref: 18/CEN/18) and Victoria University of Wellington Human Ethics Committee (Ref: #023752).

2.1. Participants

Participants were recruited via flyers on campus, university intranet email invites, and through personal interaction on campus. Any undergraduate student currently enrolled at Victoria University of Wellington was eligible. Before attending the focus groups, participants were emailed study information sheets, which provided a background of the study, methods, and confidentiality aspects pertaining to the study.

2.2. Procedures

Detailed focus groups were held in quiet, private meeting rooms at the university campus. On the day of interview, written consent was obtained. Participants could leave the discussion any time they wished without providing any reason. A NZD 20 gift voucher card was given to each participant as an expression of thanks at the end of the focus group. For this paper, pseudonyms have been used for the participant names to maintain their confidentiality.

A set of semi-structured questions was prepared beforehand, and questions were then directed towards a topic of interest as the interview progressed. Leads were then taken to further assess the lifestyle barriers mentioned.

2.3. Analysis

Each focus group was digitally recorded using an iPad and an audio recorder. Each interview was transcribed to produce a verbatim textual file. The data collected were analysed thematically by the lead investigator (S.Z.) with the aid of NVivo software (qualitative data analysis software; QSR International Pty Ltd. Version 12, Melbourne, Australia). Relevant data fragments were coded, and a constant comparative approach was used to ensure the codes were used consistently [24]. These codes were grouped into categories and summed into main themes. These final emerging themes, which were assessed against the coded transcripts and sent back and forth to the co-supervisor (H.D.) and supervisor (E.D.) to ensure they represented the data appropriately. The constant review by the co-supervisor and supervisor ensured that the integrity of the data and the results was maintained.

Focus groups were conducted until the same themes and subthemes kept appearing to the point where we did not hear any new theme or subthemes i.e., data saturation was reached. One more focus group was conducted at this point, as is usual for qualitative research [25].

2.4. Data Collected, Population Demographics and Statistics

A total of 28 participants participated in these focus groups: 7 males and 21 females aged between 16 and 35 years. Each focus group lasted around 1 h. The minimum number of participants we had in a focus group was 2 participants, while the maximum we had was 11.

3. Results

3.1. Themes

From the data, we identified three main themes: socio-cultural barriers (peer pressure and cultural norms); personal barriers (time, cost, and diet preferences); and other barriers (medical illness and lack of symptoms associated with low BMD).

The themes and subthemes are discussed in detail below.

3.1.1. Socio-Cultural Barriers

Peer Pressure

Peer pressure emerged as a significant barrier that led to participants engaging in behaviours that were detrimental to bone health. Participants reported that behaviours such as excessive alcohol consumption and smoking cigarettes were due more to peer pressure than personal preference.

“I would say the same, like there definitely does seem to be more pressure like if you are not drinking and they are like ‘Ahh, why aren’t you drinking?’ So, I will be like I don’t drink. ‘What’s wrong with you? Have a drink now!’ It’s like, so I sort of found that instead of maybe changing my behaviour in terms of drinking, I would just be like I am not going. I would rather just avoid having the social pressure of being told to drink when I don’t want to drink” (Anna)

“There are lots of social pressures at times. I take something that looks like a beer bottle, so no one asks me any questions.” (Stella)

Although participants acknowledged the detrimental effects of drinking too much alcohol on their health, they regarded this behaviour as temporary and driven by social pressure. This behaviour was more prevalent among younger participants, with older participants also reporting social pressure in the past.

“ . . . I started studying when I was 26. Umm I went to university where all my course mates were like somewhere between 18 and 20, where this was definitely a very prevalent thing, but I was mostly not hanging out with them, so I was like yeah whatever. But you know it’s definitely a thing you feel, it’s probably a very student thing and maybe you can confirm that you know. And it does still occasionally happen, but you cannot avoid hanging out with friends and you are just going to keep drinking. Not very often. But it’s weird habit, I think it starts off with social reasons and you feel like you are excluded if you can’t participate and all that, but I feel like as time passes, you’ll notice you can be social with less than few drinks, probably more social.” (Max)

Despite being conscious of the harmful effects of smoking on health, participants engaged in it due to group pressure. Participants reported the behaviour was more customary than addictive. This was not something they would do daily, but social interaction precipitated these smoking behaviours.

“ . . . and every few years we go back for a holiday, and whenever I go back, I smoke. I meet with old friends, and you know you go out, and it’s kind of a special occasion, and I realize every time I end up smoking, and then it’s like why I am doing this. You know, it’s kind of the old habits.” (Andrew)

3.1.2. Cultural Norms

Cultural factors emerged as a barrier impacting PBM, with habits such as smoking and heavy alcohol consumption being more prevalent in some cultures. Participants felt that drinking alcohol was a part of New Zealand culture and was common at social events. Participants reflected that although they were aware of how unhealthy these habits could be for their health, they still indulged in them because of perceived cultural or social obligations.

“I think in New Zealand we don’t, we know about the effects of alcohol but because it’s a socio, like Rugby, specially just like the social culture in New Zealand, we don’t, it’s the first thing we don’t think about. Like if you think of alcohol, you think of partying, friends and celebrating, dancing. You don’t think about the effects until the next morning or whatever.” (Tiare)

Participants acknowledged that these habits were instilled by culture and often surfaced with social gatherings. These habits were not necessarily undertaken to enjoy any associated intoxicating effects but rather more as a cultural norm.

“Yes, we have friends in the, like every now and then, um when we have like a big barbeque and children are playing and it’s kind of long thing. Umm, sometimes there will be someone who’s visiting, like a mom or dad that is staying with the family and they would have smokes, and we’re like, ok can I have bit of that? But it’s kind of, when you are having drinks, it’s kind of just one of a thing. But yeah, you are right; it’s kind of, very cultural.” (Andrew)

Culture also had an influence on diet. Different cultures have different food cuisines with varying intake of foods with adequate amount of calcium such as dairy, meat, green leafy vegetables, etc. Some participants found this link interesting as they felt ‘back home’; people from their culture had different lifestyle routines, which may affect their PBM positively or negatively.

“Oh yeah for the food there is one thing I forgot to say that maybe because we eat, Chinese people eat a lot green stuff, the vegetable, we eat a lot like compared to foreigners or Kiwi people. Yeah because they eat, they eat red meat a lot, yeah but we eat less compared to them. We eat more vegetables or the green leaf stuff, yeah.” (Colin)

3.2. Personal Barriers

3.2.1. Time

A lot of participants stressed ‘time’ as a major lifestyle barrier, with many experiencing difficulties in maintaining a healthy work/life balance. Participants expressed their desire to stay healthy and fit but felt that their busy lifestyle was a hindrance in attaining a better PBM. Specifically, many felt that university stress, studies, and work left them with little time to prepare healthy meals.

“Like the busyness of the lifestyle sometimes, you just don’t have time to exercise, or you settle for takeaway when you could have cooked something healthier or so yeah time But I guess it’s time and the routines of work and life balance and those things.” (Andrew)

There were also some young parents in the focus groups who had an added responsibility of looking after a child, which led them to ignore their own health preferences.

“ . . . it’s like having to be at Uni all the time, and then also having to have look after a child all the time, there’s not heaps of time in between to think about my health right now. So, it’s very much like pushed to the side, it’s something I care about but like” (Lea)

Additionally, for a few participants, a major portion of the day was spent commuting. Living close or far from university affected time involved in commuting. Such participants felt that distance along with time acted as a lifestyle barrier.

“I agree with the time thing for myself. I walk to Uni and I walk to work, that is just because I live close. But time wise like I said earlier I really only have free time at nights when I am really really tired (girls laughing). Yeah, like I study and work, I volunteer so it takes up everything, yeah.” (Cathy)

3.2.2. Cost

The next theme that emerged as a barrier in lifestyle behaviours was cost. For some participants, affordability of healthier lifestyle behaviours, such as buying nutritious food, was a deterrent. However, for others, they felt this was just an excuse, and it was more about prioritizing lifestyle choices. A few participants felt that eating healthy food costs more than the pre-packaged/processed food found in supermarkets, which is cheaper and easily available, and they attributed this expense as a barrier to healthy dietary habits.

“Maybe another barrier would be, even if you are, if you try to get, I mean, best food products is expensive . . . I mean if just to eat, as healthy as you can, you know, the highest level of healthy food. It’s becoming more expensive, there is a gap, the kind of mainstream food that you get in supermarkets, if you are aware of it exactly, you know the labelling, most of it is like, and you know this is not really ideal.” (Andrew)

“ . . . For me anyway it was stepping a lot towards more home foods. It is a bit more expensive to do.” (Rose)

3.2.3. Dietary Calcium Intake, including Dairy Product Consumption

The next lifestyle barrier that emerged in attaining better PBM was personal diet preferences. There is strong evidence linking bone mass to consumption of calcium rich foods. A major source of calcium is dairy products, yet we found that many participants refrained from consuming these, and we wished to discuss this in the focus groups. A lot of participants had specific diet preferences for several reasons. While some of them decided to be vegan for environmental/ethical reasons, others decided to avoid dairy due lactose intolerance or health issues.

“It was definitely environmental to begin with. I wasn’t raised that way at all in my family but just about 3 years ago I went through my whole process of finding things up, mostly to do with industry and the environment. Then you just suddenly grow to appreciate every aspect of it and just how better it is” (Rose)

“ . . . I’ve got endometriosis and I was fighting things, diarrhea was main stuff, yeah. I was sitting and making my symptoms worse. Yeah, I’d heard that it helps. So, I made the decision to cut it(dairy) and yeah it helps. yeah.” (Sharon)

“Yeah, I made that decision 4 years ago not to eat any meat, and I’ve included just animal milk in it. Animal milk mostly for taste reasons, I still eat cheese and I still eat eggs.” (Lisa)

3.3. Other Barriers

3.3.1. Medical Illness

A small number of participants had a history of medical illness. These health issues led to behaviours that either had a positive or negative impact on bone health, such as taking vitamin D/calcium supplementation.

“ . . . my doctor told me to take it. Because I have Crohn’s disease, so I probably don’t get enough calcium that goes in my diet so for absorption I have to take.” (Eva)

“I grew up eating entirely different diet from now, like lots of milk, Nutella like. I was just a terrible eater; my parents were like whatever makes you full. So, like I have changed a lot and the reason why I was interested in this study at the time, in a way I have been thinking a little bit about Osteoporosis. Because I have just found out that I have PCOS which in like lowest regards in terms of what is happening and one of the risks for that is high risk of Osteoporosis.” (Rose)

Another participant talked about poor bone health in her family and how adopting a healthier lifestyle led to change in behaviours that were osteoprotective. The positive changes that were instilled in the current generation could hopefully be carried forward in future generations, thus reducing the burden of osteoporosis.

“In my family we have very poor history of like health issues. I think it has a lot to do with my culture like the way my parents were brought up in the islands and the food A lot of my family members had passed due to health issues in the islands. And so, it wasn’t just my parents, it was my aunties and uncles, they decided collectively . . . they are going to change lifestyles. And so, we grew up pretty much well, like really well, always active and so my parents ate like that as well. And so, and specially my mum, she had diabetes, when I was quite young, when I was about 10. And now she doesn’t anymore so it enabled her to be more active with like me and my dad, we would go up for a walk, . . . and so for my mum its really special to her because she couldn’t do that in the past and so she is so encouraging to keep it up in the future. You know so when I have my own family, I would be able to have to with my own husband, my children, even with my nephews and nieces just so that, having a healthy lifestyle growing up and they want to decrease my chances of getting health issues genetically but more inclined to get whatever my family had been through. So, they want to decrease those chances for me and they want me to decrease those chances for next generation in my family.” (Tiare)

Although a minor theme, it demonstrated how a medical illness can improve one’s self-efficacy and lead to behaviours that are osteoprotective.

3.3.2. Lack of Symptoms Associated with Low Bone Mass Density

A small set of participants attributed the lack of visible symptoms of osteoporosis to be a barrier to purposefully engaging in behaviours beneficial to bone health. As osteoporosis manifests itself much later in life, it is difficult to gauge whether one is prone to developing weak bones. This was reported by a few participants who acknowledged that there are commonly no obvious symptoms during early adulthood, and participants perceived

osteoporosis to be a post-menopausal disease. Moreover, the diagnostic test which measures osteoporosis, through assessing BMD (via dual energy X-ray absorptiometry scan) is not routinely offered to people under the age of 65. This lack of visible symptoms did come across as a lifestyle barrier.

“I guess its lack of visible symptoms that you can see. Like, you can’t see your bones and like if like, something really happens, and if I do worse case scenario. But there’s like no in between, from that time when worst case scenario happens, so it’s not something that occupies your mind all the time. So, it’s like, you know what, I can cheat up a little today, I can make up with cheese tomorrow and then tomorrow never comes and after a while it becomes a little imbalanced. But I guess for me its lack of something that I can see visibly and there’s no visible symptom that I can see” (Aiden)

“I have never once considered my bone health . . . that’s something, you should really think about, like I’ve never broken a bone either, and it’s not something that’s really talked about until like menopause age, so, nope.” (Lea)

4. Discussion

The aim of this study was to investigate the barriers to lifestyle factors other than physical activity important for optimal PBM acquisition—namely, diet, cigarette smoking, and alcohol consumption. By undertaking focus groups in New Zealand University students, we identified three major themes: socio-cultural barriers (peer pressure and cultural norms); personal barriers (time, cost, and diet preferences); and other barriers (medical illness and lack of symptoms associated with low bone mass density). These findings might facilitate the development of public health interventions designed to help young adults embrace osteoprotective lifestyles, and hence reduce the burden of osteoporotic fracture in later life. This work is important as lifestyle choices account for 20–40% of adult PBM [10]; by the early third decade of life, most adults have attained a PBM that determines their risk of osteoporotic fracture [26].

Regarding socio-cultural barriers, a previous comprehensive review of knowledge, beliefs, and practices regarding osteoporosis among adolescents and young adults reported low perceived susceptibility and seriousness about this disease, leading to low rates of osteoprotective behaviours [13]. Although there is a growing literature of the impact of lifestyle on bone health in young adulthood [10–12,27–31], many adults in this stage of the lifecourse may of course be unaware of this evidence base. Our study found that socio-cultural factors encouraged more negative behaviours such as smoking cigarettes and drinking excessive amounts of alcohol as a social obligation [32,33]. The importance of social factors to lifestyle has also been reported in other studies—for example, a Dutch study considered attitudes towards alcohol consumption in adolescents and found that curiosity was an important factor for starting alcohol drinking, followed by peer pressure [34]. This calls for more education and awareness about the impact of alcohol consumption and smoking on bone health when considering other public health messaging.

Cultural factors may also impact on dietary choices. One study demonstrated that cultural differences between US and Chinese university students may lead to differences in dietary and physical activity habits among students [19]. Calcium is naturally found in dairy products (especially milk, yoghurt, and cheese), green leafy vegetables (especially broccoli and spinach), some fish (especially salmon and sardines), fruits (especially citrus), beans, and other miscellaneous foods such as sesame seeds, almonds, and brown sugar [35]. The typical Chinese diet consists of cereals and vegetables, with a minimal intake of animal products, limiting calcium availability [36]. Similar diet preferences were observed among the 15% of Asian participants in our focus groups. Apart from cultural diet preferences, many participants abstained from consuming dairy due to dietary intolerance and ethical/environmental issues.

Personal barriers identified in our study ranged from limited time to financial constraints in adopting a lifestyle impacting BMD positively. Participants often ended up prioritising work and studies that led to putting off osteoprotective behaviours, such as

eating well. Cost was also cited as an important barrier. Despite having good accessibility to food rich in calcium in New Zealand, their consumption was limited due to it being expensive, specific dietary patterns, or personal health reasons. While some of these factors, specifically expense and health reasons, may be hard to impact, a previous US study of 18- to 24-year-olds trialling an intervention combining traditional lecture and interactive activities for 15 weeks successfully changed eating behaviours and increased total milk consumption among students [37], suggesting behaviours can be modified in this age group.

Lastly, other barriers included a history of medical illness and lack of visible symptoms. We found that participants with a history of medical illness better perceived poor BMD to be a potential issue, which led to increased self-efficacy and in turn leading to osteoprotective behaviours.

There were of course some potential limitations of the current study. First, the sample was focused on a university population, which may not be transferrable to non-student population groups, as different lifestyle barriers could emerge for a non-student population group. For this reason, it would be useful to undertake similar studies in other settings. Second, during the discussions, one participant might have talked more than others or when a small group arrived at a consensual agreement regarding something, this may have left individuals with a difference of opinion voiceless. Such situations were handled by the researcher by moderating the discussion by keeping it open for all. Lastly, all researchers tend to hold their own perspectives or positions on the research topic, which might lead to the development of different understandings of a situation under study, requiring reflection after each focus group. The strengths of this study include the participants' wide ethnic diversity and age range. Ideas were summarised after each discussion group. The reflexive diary (preliminary analysis) after each focus group meeting with the study facilitators permitted continuous comparisons and consensus, and the data were interpreted independently. Debriefing sessions held with the study facilitators were used to highlight any discussion issues to be addressed, including any keywords, themes, or patterns and relationships identified from the focus groups.

5. Conclusions

The aim of this study was to investigate the barriers to lifestyle factors other than physical activity important for optimal PBM acquisition—namely, diet, cigarette smoking, and alcohol consumption. As reported by other studies, we found that engaging in osteoprotective behaviours are complex because they are influenced by personal and social factors. The data presented here may be helpful in the generation of interventions to promote bone health. Traditionally, efforts have targeted individual level factors such as weight bearing exercises, dairy intake, or vitamin D supplementation, but this study supports the idea that, to be effective, public health measures will need to address lifestyle factors such as socio-cultural conditions and personal implications that influence bone health seeking behaviour in young adults.

Author Contributions: Conceptualization, E.D.; methodology, E.D., H.D. and H.P.; formal analysis, H.D. and S.Z.; writing—original draft preparation, S.Z.; writing—review and editing, E.D. and H.D.; supervision, E.D. and H.D.; project administration, H.P. and S.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Boards of the New Zealand Health and Disability Ethics Committee (Ref: #HDEC 18/CEN/18) and Victoria University of Wellington Human Ethics Committee (Ref: #023752). 11 October 2018.

Informed Consent Statement: Ethical approval was obtained from the New Zealand Health and Disability Ethics Committee (Ref: #HDEC 18/CEN/18) and Victoria University of Wellington Human Ethics Committee (Ref: #023752).

Conflicts of Interest: S.Z. declares that they have no potential conflicts of interest. H.D. declares that they have no potential conflicts of interest. H.P. declares that they have no potential conflicts of interest. E.D. has received speaker and consultancy fees from Viatrix, Pfizer, UCB, and Lilly. The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

References

1. Glaser, D.L.; Kaplan, F.S. Osteoporosis: Definition and clinical presentation. *Spine* **1997**, *22* (Suppl. S24), 12s–16s. [[CrossRef](#)] [[PubMed](#)]
2. Osteoporosis New Zealand. Annual Report. 2017. Available online: <https://osteoporosis.org.nz/wp-content/uploads/ONZ-2017-Annual-Report-WEB.pdf> (accessed on 1 July 2021).
3. Watts, J.J.; Abimanyi-Ochom, J.; Sanders, K.M. *Burden of Disease Analysis 2012–2022*; Osteoporosis: Melbourne, Australia, 2013.
4. Heaney, R.P.; Abrams, S.; Dawson-Hughes, B.; Looker, A.; Marcus, R.; Matkovic, V.; Weaver, C. Peak Bone Mass. *Osteoporos. Int.* **2000**, *11*, 985–1009. [[CrossRef](#)] [[PubMed](#)]
5. Hernandez, C.J.; Beaupré, G.S.; Carter, D.R. A theoretical analysis of the relative influences of peak BMD, age-related bone loss and menopause on the development of osteoporosis. *Osteoporos. Int. A J. Establ. Result Coop. Between Eur. Found. Osteoporos. Natl. Osteoporos. Found. USA* **2003**, *14*, 843–847. [[CrossRef](#)] [[PubMed](#)]
6. Holroyd, C.; Harvey, N.; Dennison, E.; Cooper, C. Epigenetic influences in the developmental origins of osteoporosis. *Osteoporos. Int. A J. Establ. Result Coop. Between Eur. Found. Osteoporos. Natl. Osteoporos. Found. USA* **2012**, *23*, 401–410. [[CrossRef](#)]
7. Rizzoli, R.; Bianchi, M.L.; Garabedian, M.; McKay, H.A.; Moreno, L.A. Maximizing bone mineral mass gain during growth for the prevention of fractures in the adolescents and the elderly. *Bone* **2010**, *46*, 294–305. [[CrossRef](#)]
8. Weaver, C.M. Parallels between nutrition and physical activity: Research questions in development of peak bone mass. *Res. Q. Exerc. Sport.* **2015**, *86*, 103–106. [[CrossRef](#)]
9. Oh, E.G.; Lee, J.E.; Yoo, J.Y. A systematic review of the effectiveness of lifestyle interventions for improving bone health in women at high risk of osteoporosis. *JBI Libr. Syst. Rev.* **2012**, *10*, 1738–1784. [[CrossRef](#)]
10. Weaver, C.M.; Gordon, C.M.; Janz, K.F.; Kalkwarf, H.J.; Lappe, J.M.; Lewis, R.; O’Karma, M.; Wallace, T.C.; Zemel, B.S. The National Osteoporosis Foundation’s position statement on peak bone mass development and lifestyle factors: A systematic review and implementation recommendations. *Osteoporos. Int. A J. Establ. Result Coop. Between Eur. Found. Osteoporos. Natl. Osteoporos. Found. USA* **2016**, *27*, 1281–1386. [[CrossRef](#)]
11. Bielemann, R.M.; Martinez-Mesa, J.; Gigante, D.P. Physical activity during life course and bone mass: A systematic review of methods and findings from cohort studies with young adults. *BMC Musculoskelet Disord.* **2013**, *14*, 77. [[CrossRef](#)]
12. Rizzoli, R. Dairy products, yogurts, and bone health. *Am. J. Clin. Nutr.* **2014**, *99* (Suppl. S5), 1256s–1262s. [[CrossRef](#)]
13. Chan, C.Y.; Mohamed, N.; Ima-Nirwana, S.; Chin, K.Y. A Review of Knowledge, Belief and Practice Regarding Osteoporosis among Adolescents and Young Adults. *Int. J. Environ. Res. Public Health* **2018**, *15*, 1727. [[CrossRef](#)] [[PubMed](#)]
14. Patel, H.D.H.; Zafar, S.; Spittle, P.T.; Dennison, E. Knowledge of osteoporosis and lifestyle behaviours impacting peak bone mass: Might we be able to modify behaviour in young adulthood to prevent osteoporosis in later life? *OBM Geriatr.* **2020**, *5*, 14. [[CrossRef](#)]
15. Hsieh, C.H.; Wang, C.Y.; McCubbin, M.; Zhang, S.; Inouye, J. Factors influencing osteoporosis preventive behaviours: Testing a path model. *J. Adv. Nurs.* **2008**, *62*, 336–345. [[CrossRef](#)] [[PubMed](#)]
16. Sharma, S.V.; Hoelscher, D.M.; Kelder, S.H.; Diamond, P.; Day, R.S.; Hergenroeder, A. Psychosocial factors influencing calcium intake and bone quality in middle school girls. *J. Am. Diet. Assoc.* **2010**, *110*, 932–936. [[CrossRef](#)]
17. Schmiede, S.J.; Aiken, L.S.; Sander, J.L.; Gerend, M.A. Osteoporosis prevention among young women: Psychosocial models of calcium consumption and weight-bearing exercise. *Health Psychol.* **2007**, *26*, 577–587. [[CrossRef](#)] [[PubMed](#)]
18. Gamage, K.L.; Klentrou, P. Predicting osteoporosis prevention behaviors: Health beliefs and knowledge. *Am. J. Health Behav.* **2011**, *35*, 371–382. [[CrossRef](#)]
19. Ford, M.A.; Bass, M.; Zhao, Y.; Bai, J.B.; Zhao, Y. Osteoporosis Knowledge, Self-Efficacy, and Beliefs among College Students in the USA and China. *J. Osteoporos.* **2011**, *2011*, 729219. [[CrossRef](#)]
20. de Silva, R.E.E.; Haniffa, M.R.; Gunathillaka, K.D.; Atukorala, I.; Fernando, E.D.; Perera, W.L. A descriptive study of knowledge, beliefs and practices regarding osteoporosis among female medical school entrants in Sri Lanka. *Asia Pac. Fam. Med.* **2014**, *13*, 15. [[CrossRef](#)]
21. Barzanji, A.T.; Alamri, F.A.; Mohamed, A.G. Osteoporosis: A study of knowledge, attitude and practice among adults in Riyadh, Saudi Arabia. *J. Community Health* **2013**, *38*, 1098–1105. [[CrossRef](#)]
22. Von Hurst, P.R.; Wham, C.A. Attitudes and knowledge about osteoporosis risk prevention: A survey of New Zealand women. *Public Health Nutr.* **2007**, *10*, 747–753. [[CrossRef](#)]
23. Patel, H.D.H.; Spittle, P.T.; Dennison, E. Understanding the Barriers and Enablers to Sporting Activity in Relation to Bone Health: A Qualitative Narrative Study among Adolescents and Young Adults in New Zealand. *J. Osteoporos. Phys. Act.* **2020**, *8*, 220.
24. Flick, U. (Ed.) *The SAGE Handbook of Qualitative Data Analysis*; SAGE Publications Ltd: London, UK, 2014; 2020/03/18. Available online: <https://methods.sagepub.com/book/the-sage-handbook-of-qualitative-data-analysis> (accessed on 1 July 2021).

25. Moser, A.; Korstjens, I. Series: Practical guidance to qualitative research—Part 3: Sampling, data collection and analysis. *Eur. J. Gen. Pract.* **2018**, *24*, 9–18. [[CrossRef](#)] [[PubMed](#)]
26. Baxter-Jones, A.D.; Faulkner, R.A.; Forwood, M.R.; Mirwald, R.L.; Bailey, D.A. Bone mineral accrual from 8 to 30 years of age: An estimation of peak bone mass. *J. Bone Miner. Res. Off. J. Am. Soc. Bone Miner. Res.* **2011**, *26*, 1729–1739. [[CrossRef](#)] [[PubMed](#)]
27. Zhu, K.; Prince, R.L. Lifestyle and osteoporosis. *Curr. Osteoporos Rep.* **2015**, *13*, 52–59. [[CrossRef](#)]
28. Kanis, J.A.; Johnell, O.; Odén, A.; Johansson, H.; De Laet, C.; Eisman, J.A.; Fujiwara, S.; Kroger, H.; McCloskey, E.V.; Mellstrom, D.; et al. Smoking and fracture risk: A meta-analysis. *Osteoporos. Int. A J. Establ. Result Coop. Between Eur. Found. Osteoporos. Natl. Osteoporos. Found. USA* **2005**, *16*, 155–162. [[CrossRef](#)] [[PubMed](#)]
29. Klein, R.F. Alcohol-induced bone disease: Impact of ethanol on osteoblast proliferation. *Alcohol Clin. Exp. Res.* **1997**, *21*, 392–399. [[CrossRef](#)]
30. Seo, S.; Chun, S.; Newell, M.A.; Yun, M. Association between alcohol consumption and Korean young women's bone health: A cross sectional study from the 2008 to 2011 Korea National Health and Nutrition Examination Survey. *BMJ Open* **2015**, *5*, e007914. [[CrossRef](#)]
31. Yoon, V.; Maalouf, N.M.; Sakhaee, K. The effects of smoking on bone metabolism. *Osteoporos. Int. A J. Establ. Result Coop. Between Eur. Found. Osteoporos. Natl. Osteoporos. Found. USA* **2012**, *23*, 2081–2092. [[CrossRef](#)]
32. Russell, L.D.; Arthur, T. "That's What 'College Experience' is": Exploring Cultural Narratives and Descriptive Norms College Students Construct for Legitimizing Alcohol Use. *Health Commun.* **2016**, *31*, 917–925. [[CrossRef](#)]
33. Pateman, K.; Ford, P.; Fitzgerald, L.; Mutch, A.; Yuke, K.; Bonevski, B.; Gartner, C. Stuck in the catch 22: Attitudes towards smoking cessation among populations vulnerable to social disadvantage. *Addiction* **2016**, *111*, 1048–1056. [[CrossRef](#)]
34. Janssen, M.M.; Mathijssen, J.J.; van Bon-Martens, M.J.; van Oers, H.A.; Garretsen, H.F. A qualitative exploration of attitudes towards alcohol, and the role of parents and peers of two alcohol-attitude-based segments of the adolescent population. *Subst. Abus. Treat. Prev. Policy* **2014**, *9*, 20. [[CrossRef](#)] [[PubMed](#)]
35. WHO Scientific Group on the Prevention and Management of Osteoporosis. *Prevention and Management Of Osteoporosis: Report of a WHO Scientific Group*; World Health Organization: Geneva, Switzerland, 2003.
36. Du, S.; Mroz, T.A.; Zhai, F.; Popkin, B.M. Rapid income growth adversely affects diet quality in China—Particularly for the poor! *Soc. Sci. Med.* **2004**, *59*, 1505–1515. [[CrossRef](#)] [[PubMed](#)]
37. Ha, E.J.; Caine-Bish, N.; Holloman, C.; Lowry-Gordon, K. Evaluation of effectiveness of class-based nutrition intervention on changes in soft drink and milk consumption among young adults. *Nutr. J.* **2009**, *8*, 50. [[CrossRef](#)] [[PubMed](#)]