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*Article*

# Children's Knowledge of Factors Associated with Bone Health in New Zealand: A Qualitative Study

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**Abstract: Background:** Low peak bone mass (PBM) is a major contributor to later osteoporosis risk. This study sought to understand young people's knowledge of factors associated with bone health. **Methods:** School children in Aotearoa New Zealand were approached. Eight focus groups (26 participants in total, aged 11 to 17 years) were conducted using a semi-structured approach with open-ended questions and prompts. Transcripts were thematically coded using an inductive content analysis approach. **Results**: Knowledge of factors associated with good bone health was limited. There was a general awareness of the positive and negative impacts of many lifestyle behaviours on health generally, but not specifically PBM. Dairy intake was commonly mentioned as being beneficial for bone health. Some participants reported potential benefits of sport on bone health, but most did not know that weight bearing activity specifically was beneficial. **Conclusions:** Knowledge of osteoporosis and lifestyle factors that impact PBM was limited. Educational interventions involving promotion of bone health knowledge in adolescents may be an important contributor to public health strategies.

**Keywords:** knowledge; bone; qualitative; lifestyle; peak bone mass (PBM); osteoporosis

## 1. Introduction

Osteoporosis and its association with fragility fractures is a public health problem that requires intervention across the lifecourse (Cole et al., 2008; Glaser & Kaplan, 1997). Critical periods of bone development occur during childhood and adolescence, with peak bone mass (PBM) achieved in one's twenties and thirties. Despite this, most osteoporosis interventions primarily focus on older people (Skinner et al., 2024). PBM is determined in part by physical activity and dietary calcium intake; these might therefore be adjusted to improve bone health and reduce fracture risk in later life (Hernandez et al., 2003; Tan et al., 2014; Weaver et al., 2016; Winther et al., 2015). Whether adolescents and young adults take advantage of these critical periods may be dependent on their awareness of factors associated with good bone health and motivation to lead healthy lives (Holland, 2017).

We have previously demonstrated that knowledge of PBM and risk of osteoporotic fracture was limited in university aged students in a study conducted in 2018–2019 (Patel, Denison, et al., 2021). Unless students had participated in health-related subjects in later years of school or university, students recalled little bone health information. It was uncertain whether this reflected failure to teach relevant material or its retention over subsequent years. Although bone health education in Aotearoa New Zealand still typically focuses on anatomy, structural function, and injury prevention (Life Education Trust, 2024), information about the importance of encouraging an osteogenic lifestyle during childhood and adolescence has increased in availability through other routes, such as websites

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(Better Health Osteopathy, 2016). We were interested in speaking to children and adolescents to gain an appreciation of their knowledge of factors linked to bone health. PBM acquisition begins around the time of puberty, so lifestyle factors will play an increasingly important role from this period of life onwards. We were therefore particularly interested in talking to participants within the 11–17 year old age range.

The current study therefore aimed to explore what adolescents understand about PBM and the lifestyle factors that impact bone health. We employed qualitative methodology through focus groups with school aged children (11 to 17 years of age) in Te Whanganui-a-Tara, Wellington, Aotearoa New Zealand.

## 2. Materials and Methods

*Participants*

Study recruitment was undertaken from March 2021 to November 2023 in Te Whanganui-a-Tara Wellington region in Aotearoa New Zealand. School-aged students (aged 11–17, inclusive) from local suburbs of Te Whanganui-a-Tara Wellington were approached to participate in the study. There were no exclusion criteria, but all participants were required to give verbal and written consent or written assent and guardian consent. Some participants had previously attended schools that were involved in a larger bone health study and recruited as part of a feasibility study in the use of heel ultrasound as a measure of bone health in children (Patel, 2020; Patel, Woods, et al., 2021). School principals gave verbal and written approval to conduct the study with consenting participants. Others were recruited through word of mouth, recruitment flyers, and emails posted through school media services. Participants were provided with participant information sheets and informed assent and consent forms. Written informed consent was provided by willing participants or written assent along with their guardian's written consent was obtained if aged 15 years or under. The focus groups were semi-structured with open-ended questions to guide the discussions. Select questions were used as a prompt to further open the topic to children and adolescents (Table 1).

**Table 1.** Interview Guide Questions, **Main research question:** What do adolescents and young adults understand about peak bone mass and risk of osteoporotic fracture?

| |
|---|
| **Questions about knowledge:** |
| What do you understand about bone health? |
| 1. What factors do you think have negative or positive impact on your bone health? |
| 2. What food do you think effects bone health? |
| 3. What about smoking? |
| 4. What about alcohol? |
| **Questions about behaviour:** |
| 1. What are the lifestyle factors you would choose to keep your bones strong and healthy? |
| 2. What changes did you bring in your lifestyle with the knowledge you have about bone health? |
| 3. What prompts you to stay physically active? |
| 4. How important are physical activities to you in a day to day life? |
| 5. How do you think food affects your bone? What changes did you bring in your diet to have strong bones? |
| 6. How about dairy products consumption? |
| 7. Have you ever sought any medical care for bone pain/fracture? |
| 8. Have you ever heard about osteoporosis/peak bone mass? |
| 9. How do you think your bone health relates to risk of fracture later in life? |

Within small groups, participants were first made to feel comfortable and permitted to chat about their day before discussing what they understood about PBM and the risk of osteoporotic fracture affecting their bone health. Prompts were given to elucidate what participants understood

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about bone health (for example: "What factors do you think have negative or positive impact on your bone health? What food do you think affects bone health? What about the effects of smoking and alcohol?"). Participants were encouraged to direct the discussion with minimal intervention from the study facilitators.

The discussions were recorded with two or more recording devices. An assistant recorded non-verbal communication to record information about the level of consensus and dissension to the topic under discussion. At the end of each discussion, the lead interviewer summarised the ideas that had been discussed and asked for any final feedback to ensure all ideas, opinions, and experiences were recorded. After each focus group, a debriefing session was held with the study facilitators where notes were logged as a reflexive diary to be used as part of the preliminary analysis. Subsequent focus group interviews used an iterative process whereby any previous emergent themes were followed up to obtain further insights. This meant all themes were fully explored to achieve theoretical data saturation.

*Ethics Statement*

Ethical approval was obtained from the New Zealand Health and Disability Ethics Committee (reference #HDEC 18/CEN/18 and ~~2023~~ PR 7322 3rd February 2021) in accordance with the ethical standards of the university and national research committee and with the 1964 Helsinki declaration (World Medical Association, 2025). Approval included Māori consultation and meaningful discussions with Māori and whānau family as part of a recognised principle of protection and partnership under Te Tiriti o Waitangi the Treaty of Waitangi to help eliminate Māori health inequities in health research (National Ethics Advisory Committee, 2024).

*Data analysis*

The recordings of the focus group discussions were transcribed verbatim and verified by listening to the voice recordings several times to ensure all data was recorded correctly. All participants' data were de-identified. The transcription and any tabulated data, including any notes obtained from the focus groups were thematically analysed. We used an iterative process of qualitative analysis whereby inductive patterns emerge into themes from the data itself by constant comparative analysis (Corbin, 1998). Sections of data were assigned codes and compared for consistency. The assigned codes were categorised into themes. NVivo (qualitative data analysis software; QSR International Pty Ltd. Version 15, 2024) was used to organise the data.

## 3. Results

Eight focus group discussions were held between March 2021 and November 2023, with 2 to 4 participants attending each group. The total sample size was 26 individuals ranging from 11 to 17 years of age, with a mean age of 14.46 (± 1.7), see Table 2.

**Table 2.** Participants' Characteristics.

| **Participants' Characteristics** | |
|---|---|
| Age range | 11 to 17 years |
| Average age | 14.46 (± 1.7) years |
| Ethnicity | 13 European, 8 mixed Māori & Pacific people, 5 Asian and Indian origin |
| Gender | Female 22: Male 4 |
| Education level | Secondary school (Year 7 to Year 13) |

Half of the participants were of European descent, while 13 were of other ethnicities (including Māori, Pacific people, Asian, and Indian). Most participants were female (22:4).

Several major themes emerged from the focus groups. Overall, there was still a limited understanding of PBM and the risk of osteoporosis. Although participants had a good understanding

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of lifestyle factors that contributed to general good health, they had little knowledge of how these could lead to improved PBM.

### *Limited awareness of PBM and the risk of osteoporotic fracture*

Study participants typically had a limited awareness of PBM and osteoporotic fracture.

*[13,14,15 females] Have you ever heard of osteoporosis? "No."*

*[13 female] "I've heard that but I don't know, oh I know there is an ad on TV about osteoporosis. No, I don't know what it is but I can't remember."*

Participants did report that bones change with age. They understood as people get older, their ability to stay strong deteriorates. Fragility was often associated with older females, such as their grandmothers.

*[15 female] "Think they get worse as they get older."*

*[16 female] "What you are doing when you're young impacts you when you are older."*

*[15 female] "And so like my nanna broke her bones, she was fragile, when she fell she broke her spinal cord and stuff, like this one of them. They become more fragile. So I think when you get older they become more fragile and breakable."*

*[13 female] "People, like yeah just old people like, oh I broke my hip or like arthritis, I feel like that's something with bones because they are old."*

*[14 male] "Older people may also come across that sort of fractures. In the back."*

*[14 male] "So you like stop growing like after a growth spurt."*

*[14 female] "My Nanna, something to do which her bones, she was having some minor shake, she got to a certain age her bones can fragile and she was also an age, and because of the sun. She got too much sun. Don't you like if you have like cancer then your bones become weak."*

### *Health information received is limited*

Participants recalled receiving health-related information in various forms, but none were specific to bone health.

*[11 female] "The dentist. There's a dentist one. That's right. The dentist told me about healthy eating and drinking?"*

*[12 female] "You are right, there's Harold, Harold. The giraffe [Visiting mobile education truck]. He taught us on online safety. Online Safety. He didn't teach us um, he told us like, I'm pretty sure they told us about not talking to strangers. How not to talk to strangers online. Bad to talk to strangers. At least about healthy eating. I don't think anything about bones at all."*

### *Participants had an awareness of the benefits of exercise and nutrition*

Participants were aware of the overall health and well-being benefits of exercise and good nutrition, but not specifically in relation to bone health. When asked "How do you think food affects your bones?":

*[16 female] "Eating the right stuff, eating properly, getting proper nutrients."*

*[15 male] "Eating the right foods and drink stuff."*

*[13 female] "Well, yeah, eating healthy. Having a healthy lifestyle, makes me what makes me better, exercise as well."*

When asked: "*What do you think would be a good diet?*", participants were aware of the benefits of lifestyle of eating healthy foods and participating in regular exercise. Many participants specifically mentioned dairy products as being beneficial for bones, with most mentioning calcium and dairy produce as being important. Some reduced their intake of dairy for various reasons, including dislike of dairy or some level of intolerance to consuming dairy. Participants raised concerns of the benefits of the milk substitutes and whether the advertising of these products were designed for commercial gain.

*[12 female] "I think that whole milk and cheese and yoghurt cheese."*

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*[16,17 female] "Yes calcium"*

*[16 female] "Calcium is good for you."*

*[16 female] "Isn't like calcium, makes it stronger?"*

*[14 male] "Milk, calcium I guess to help your bones stronger. Like, I guess tougher. Yeah. Yeah. doesn't break easily."*

*[17 female] "Drink milk. We all drink milk."*

*[17 female] "I know if I have milk it, if I have, it definitely makes me feel sick, yeah."*

*[13 female] "I can't drink a lot of milk, I don't feel too sick, for the most part but I do feel…fine for most part. I don't know [why]. I don't know. Like if you would think of like a vegan blogger like a life like that I feel like they would have really good bones, yeah."*

*[17 female] "I have milk substitutes like so soy, almond or oat milk. It says on TV they have, that they have good calcium but I don't know if it's true, yeah, but [it's] not much though."*

*[16 female] "And nobody knows that consumer stuff [that's] online it's just there to sell you stuff and you don't know really if it's true."*

*[14 female] "I wouldn't want to drink a cup of milk probably. Yeah, and I don't even have like cereal and I'm really sad. Cuz I don't like anyway. I am not a breakfast sort of person."*

*[17 female] "I am lactose[intolerant], so I can't have dairy."*

*[16 female] "Same, but not to the same extent probably, but some dairy things make me sick and sad."*

*[14 female] "But I haven't like it in alone. When it's mixed up with something else, you've be like. They're like a straight milk,…yuk."*

*[12 female] "Also it doesn't have to come from the cow? Do you think? it's going to be about different kinds of milk like chocolate milk, and other milks."*

### *Supplements, vitamin D, and sun influencing your bones*

Participants discussed a variety of supplements and the need to source safe levels of vitamin D from sunlight, although this discussion was less certain around the benefits for bone health. When asked: *"What about vitamins or other supplements or others things?"*, participants had limited understanding of the benefits of vitamin D for bone health, but were aware of the mental benefits of being outdoors in the sunlight, enhancing skin appearance, and other feel-good benefits.

*[16 female] "So Vitamin D. Is there a B or Vitamin C? We're going through the alphabet. Probably the sun…the sunlight. Radiation?"*

*[15 male] "I think Vitamin D's for your bones? Or something?"*

*[15 male] "[Vitamin D] helps with bones. Some of the D vitamins. Some of them help your immune system."*

*[15 male] "I think that's it. No, like you don't feel more drowsy or something. But when you're in the sun, so that like helps you like energise it gives you energy doesn't it? I am pretty sure the sun gives you it."*

*[11 female] "Yeah. Like, if it's like, really sunny, it's like it is today [sunny]. Hot sunny days you put like sunscreen on and then you think about the going out to get tanned. Yeah."*

*[13 female] "Over-rated. I think the body already produces like what we need, like in the olden days and you didn't have vitamins but… You get it from like fruit, if you're not getting that or like not fruit such but certain foods you get them from there but if you're not getting enough, and sometimes you just like I wouldn't like iron stuff because to know Your body you don't need it [supplements], it's just a way to make more companies make money on the right."*

### *Exercise and sports benefits for bone health*

While participants were aware of the benefits of sports and exercise on overall health, the discussion around bone health was limited. Awareness of the benefits of weight bearing exercise was particularly limited.

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*[14 female] "They [sports] can help to make your bones better, yeah"*

*[14 male] "Yeah, I think that strengthens them, but like overuse."*

*[15 male] "Sports strengthens your bones."*

*[13 female] "Yeah, yeah, yeah to me rowing. That really, really would be good for your bones as well. Yeah. When you row you really use muscles."*

*[14 female] "I think it would be good because then your bones are getting used to and they build up like protection for you."*

*[16 female] "I hope, like a lot when you're younger, it could be like that for, like, it could be bad for you, a lot of people like, it could be bad for them, it might not seem like a dance problems. It's a lot of knee and ankle problems. Yes, it's high impact. Well, I'm sure, like lots of jumping and it's like a lot of accident prone friends. It hurts. It's like you bones are under a lot of pressure and your bones are compacted. Friends who like know what's a good word, like contracting. I don't know. Whoa. 'it's not very good for it."*

### *The detrimental effects of smoking/vaping, drugs and alcohol*

Participants were generally aware of the detrimental effects of smoking, vaping, drugs, and alcohol on health, with several suggesting that they expected these to be detrimental to bone health. These statements appeared based on supposition rather than knowledge. When asked, *"What factors do you think have negative or positive impact on your bone health?"* at least one participant (aged 15) expressed surprise that smoking may be detrimental to bone health; others murmured in agreement.

*[16 female] "Surely alcohol, somewhere in there is there must drugs, alcohol and drugs there is something there must be bad, surely…affecting [bones]."*

*[16 female] "All drugs. Prescribed ones that you need, they could be bad."*

*[13 female] "Drugs and alcohol? No, they are bad for your bones. Sort of like how they rot your teeth and stuff."*

*[15 male] "Smoking is bad for your bones, rots them. What about coke, was something? Though but just bad in general, it's just going to damage you think the only thing that it does is calm you."*

*[16 female] "[Vaping it's] like [smoking], the same sort of thing. I mean, it's the same. Everyone doesn't think it has the same effects but I thinks it has the same effects, it's just there is only the short term research [found online] has been done that it is coming out this year. So…Yeah."*

*[15 male] "More like a bunch. 100 probably like this, a lot of this school I guess they [vaping] put less harm on your bones. So smoking is worse, a lot more, I guess. But it's not just that they say that vaping is much better than smoking. They say they're both altogether, they're both pretty bad."*

*[15 year old] "Is smoking bad for your bones?"*

### *Lack of relevant bone health education/information*

Participants did not recall being taught specifically how to improve their peak bone mass potential while they were young.

*[15 female] " I feel, yeah, it's not something that like people talk about, like, I feel like no-one is educated a lot on it."*

*[15 female] "We were just saying like, we don't really get taught much unless its PE or health and this you might get this whole internal (exam) based on it."*

*[16 female] "It feel like the only thing you learn in PE about bones is it is what you eat, like but nothing to do with how sport impacts bones or the use of them (bones)."*

*[15 female] "It's something you have to like choose to study like I want to go into PE or bio anyway because it's just like."*

*[15 female] "You should probably learn about it in health. Just generally."*

*[12 female] "I'm pretty sure we did learn about them first term. I'm positive that my teacher told us like taught us about bones. But I kind of forgot."*

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*[16 female] "Like, yes then like nothing to do with like how's."*

*[16 female] "I still don't understand how they move, like counting the bendy like the bones you actually don't understand how they move together and stuff or [I wish I] had it explained to me."*

*[11 female] "[Learning] about bones, no not about bones? No. We have this huge picture in our library and it's all about bones and grows as it grows. It's just a skeleton [picture] that's all. To know more, I should have asked about it, I guess."*

## 4. Discussion

While this study suggested that most children and adolescents were not aware of the term osteoporosis, they were aware of the benefits of dietary calcium intake for bone health, and some were also aware of the benefits of physical activity. Other studies have shown that the lack of knowledge and misconceptions about osteoporosis lead to behaviours that might result in suboptimal PBM acquisition, further highlighting the need for adequate education in this area (Chan et al., 2018; von Hurst & Wham, 2007). The risks of adult osteoporosis begins in childhood, therefore it is beneficial to convey methods of improving PBM to young people (Hereford et al., 2024). Past studies have shown that effective bone health education can lead to increased osteoporosis awareness in children and adolescents (Randi Schoenfeld et al., 2010; Sanaeinasab et al., 2014; Yoshihara et al., 2024).

Study participants associated osteoporosis with aging in females and ill health. Most bone health information came from the school environment, through conversations at school, and within social circles (such as family). Some participants felt they had been taught something but had forgotten the information. Generally, participants spoke about the internet (online) as their first source of information for many topics. However, other than to aid recovery following an injury or fracture, few participants had searched the internet for information specifically related to bone health. General healthy lifestyle promotions were recalled by participants as *"milk is good for your bones,"* but they did not recall the source of that information or what stage any bone health information/learning was delivered. Regularly reinforcing information over the school years about bone health would therefore be beneficial.

Within bone health literature, the term "impact" often refers to impact loading of sports/activities that help to determine bone mass density improvements (such as weight-bearing aerobic exercises like walking and jogging) (Simões et al., 2021). Participants had a good understanding of the detrimental effects of a limited diet, smoking/vaping, drugs, and alcohol on general health, but not specifically how these lifestyle factors influence PBM potential. Our study participants recognised that vaping may cause harm but not to the same extent as smoking tobacco. It should be noted that the potential harm of vaping products is not fully recognised on young bones although vaping is used as an alternative to smoking cigarettes (Ball et al., 2021; Morgan et al., 2024).

As previously observed in our study with young adults, awareness of obtaining vitamin D for bone development through diet and sun exposure was uncommon, and participants did not generally understand the benefits of specific nutrients, or their nomenclature (Patel, Denison, et al., 2021). There is limited awareness of the consequences of vitamin D deficiency (poor bone health and the manifestation of rickets) in Aotearoa New Zealand (Delshad et al., 2020; Wheeler et al., 2015). Vitamin D absorption through the skin through sun exposure is dependent on level of clothing coverage, skin pigmentation, and indoor versus outdoor lifestyles (Darling et al., 2019; von Hurst & Wham, 2007). This may be particularly relevant as young people may now be using electronic devices indoors—including electronic gaming—for long periods of time (de Lamas et al., 2021; Karimian et al., 2022; Ministry of Health et al., 2012).

There were several strengths and limitations to this study. A strength is that the data collected were sourced from participants from different schooling backgrounds (single sex and co-education schools), although the generalisability of this study may be considered limited to the secondary school environment. This study was undertaken in Aotearoa New Zealand, where educational

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initiatives may differ from other countries. Within our own study sampling, there was a potential for sampling and response bias, particularly as the study coordinator worked in the school environment.

Regarding limitations, participants' socioeconomic status was not covered in the demographics questionnaire. However, the participating schools were from various socioeconomic levels and included one high, middle, and low Equity Index schools. This may be significant as previous studies indicate lack of osteoporosis knowledge may result in racial disparities in bone health potential, particularly in females (Wright et al., 2019). Most of our respondents identified as female; this large gender imbalance is attributed to sampling more all-girls schools. Additionally, our study did not include those with mobility disabilities or identifying as gender diverse; this is a common limitation for studies with relatively small sample sizes (Clark et al., 2014; Graham et al., 2011; Shannon et al., 2019).

This project employed a qualitative study design; we gained insights of individuals' ideas in group settings to infer generalised theoretical patterns and perspectives of groups of children and adolescents. Trustworthiness in qualitative studies are evaluated by the study's credibility, transferability, dependability, and confirmability (Loh, 2013). The study's credibility was affirmed by obtaining data sourced from a range of participants from different socioeconomic backgrounds. Debriefing sessions were held after each focus group to identify potential ideas and to confirm that the views of the participants were captured. Observations from different facilitators, field notes, and data obtained from the transcripts were triangulated and synthesised (Carter et al., 2014). We acknowledge the focus group facilitators' life experiences and position as being more experienced on the subject matter than participants and therefore allowed the participants to shape the flow of discussion. While subjective, we noted non-verbal communication as "Yeah, yeah," or "No" and "Nah" to suggest group assent or dissent.

School-based interventions are effective methods of promoting adolescent health information in meaningful ways that are relevant to children and adolescents (Gray et al., 2013). Developing relationships between health literacy and adolescents' health behaviours will enable adolescents' decision-making capacity, which can further extend into the wider community to promote generational change (Dixon & Robertson, 2023; Fleary et al., 2018). Future research and follow up research to understand children and adolescents' experiences participating in focus groups—such as what changes to incorporate, what was important to them, and what they enjoyed—may lead to further understanding of the research undertaken.

It has been shown internationally that hospital-based classroom educational intervention programs are useful in improving teenagers' knowledge and attitudes towards their health (Galloway et al., 2012). Currently in NZ, educational initiatives such as LENScience and Harold The Giraffe (a mobile education provider) run interactive health and wellbeing inquiry programmes that cover diet, exercise, body parts, and the skeletal system (Boyle, 2014; Life Education Trust, 2024). To address the fracture fragility burden in Aotearoa New Zealand (Osteoporosis New Zealand, 2022), Osteoporosis New Zealand's initiative BoneCare 2030 aims to implement consistent delivery of bone health improvement awareness among children and adolescents, which may be passed on through the families (Gill et al., 2022).

The education response to the COVID-19 pandemic has demonstrated the potential of online learning. The World Health Organisation put forward digital literacy as a useful method of promoting health literacy through schemes that target vulnerable communities (World Health Organization, 2023). The combination of face-to-face learning and improved interactive digital learning methods may represent a cost effective way of engaging large numbers of children and adolescents in bone health education, resulting in lifelong benefits for bone health (Gashaw et al., 2021; Woods-Townsend et al., 2015; Woods-Townsend et al., 2018). Tools have been developed to promote bone health in adolescents, but require further exploration in their effectiveness (Azmi et al., 2023).

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## 5. Conclusions

In summary, young people participating in this study had relatively limited knowledge around bone health with fragmented bone health knowledge retained from various sources. Awareness within the current participants did not appear more substantial than a cohort who transitioned through secondary school education around eight years prior. National educational interventions/campaigns and policies involving specific information about lifestyles that support peak bone mass that target young people as they start to transition through puberty may be warranted.

**Author Contributions:** Elaine Dennison and Hayley Denison designed the study, with Hansa Patel. Hansa Patel performed data collection and performed data analysis. Maya Patel transcribed audio recordings. All authors oversaw manuscript production.

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**Institutional Review Board Statement:** Ethical approval was obtained from the New Zealand Health and Disability Ethics Committee (reference #HDEC 18/CEN/18 and PR 7322 3rd February 2021) in accordance with the ethical standards of the university and national research committee and with the 1964 Helsinki declaration (World Medical Association, 2025). Approval included Māori consultation and meaningful discussions with Māori and whānau family as part of a recognised principle of protection and partnership under Te Tiriti o Waitangi the Treaty of Waitangi to help eliminate Māori health inequities in health research (National Ethics Advisory Committee, 2024).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Anonymized data are available from the authors.

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**Conflicts of Interest:** The authors have declared that no competing interests exist.

## Abbreviations

The following abbreviations are used in this manuscript:

| | |
|---|---|
| PBM | Peak bone mass |
| PE | Physical education |
| TV | Television |

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