Acceptability and engagement amongst patients on oral and intravenous bisphosphonates for the treatment of osteoporosis in older adults

Abstract

Background: Osteoporosis is common in older adults leading to fragility fractures at enormous individual and economic cost. Improving long-term adherence with bisphosphonate treatments reduces fracture risk, but adherence rates for first line oral bisphosphonate alendronate remains low. While alternative treatment regimens, including annual intravenous infusions are available, patient acceptability remains unclear. Therefore, understanding patients' acceptability and engagement in different bisphosphonate regimens is important to ensure optimal treatment benefits.

Methods: Semi-structured interviews were conducted with 78 patients with a mean age of 69.9 years, who had taken or received bisphosphonates for osteoporosis within the last 24 months. Data analysis included iterative categorization and used the Theoretical Framework of Acceptability (TFA) to compare the acceptability of treatments regimens.

Results: Treatment acceptability and engagement were influenced by the extent to which patients understood the prescribed treatment, and evidence of the treatment working. Acceptability and engagement were compromised when treatment was perceived as burdensome, personal costs were incurred, and patients' values were incompatible with the regimen. The balancing of these factors contributed to patients' ability to cope with the treatment and their emotional responses. Intravenous treatment was generally perceived as easier to understand, more effective, less burdensome with fewer opportunity costs, and a preferable regimen compared with oral bisphosphonates.

Conclusions: Annual intravenous zoledronate bisphosphonate treatment was generally more acceptable to patients, perceived as more straightforward to engage in, although a small portion of patients on oral bisphosphonates were satisfied with treatment. Further research is needed to identify how acceptability and engagement can be optimised.

Introduction

Osteoporosis is a common clinical condition, and its prevalence increases with age [1]. It leads to weakened bones and susceptibility to fractures with minor trauma, commonly referred to as fragility fractures [2, 3]. In the United Kingdom (UK), there are approximately 536,000 new fragility fractures annually which include 79,000 hip fractures, 66,000 vertebral fractures (diagnosed clinically), 69,000 forearm fractures, and 322,000 fractures of the pelvis, rib, and other long bones [4], at an estimated cost of £4.4 billion per year. Fractures are often life changing events, underpinned by pain, and a loss of mobility and independence; such fractures may also lead to social isolation, depression, and increased mortality [5, 6]. Moreover, any fragility fracture increases the subsequent risk of further fracture [4]. Older adults may face the greatest health burden and poorer health outcomes from osteoporosis, with higher fracture risk occurring with advancing age, as well as the greater likelihood of contending with co-morbidities [7].

Bisphosphonates are effective in fracture prevention and remain the most widely prescribed antiresorptive agent [8, 9]. However, adherence for first line oral bisphosphonates e.g., alendronate (also known as alendronic acid) remains challenging with persistence rates reported between 16% and 60% at one year. Non-adherence can lead to poorer health, secondary fractures, wasted resources, and knock-on costs caused by increased demand on healthcare services [10]. Thus, improving long term adherence with bisphosphonates has wide-ranging benefits for patients and health services. For example, improving long term adherence with fracture prevention treatments from 60% to 80% would lead to a saving of £4.3 million for the NHS over 5 years for secondary prevention [11, 12]. The challenges of oral bisphosphonates that have been reported amongst patients include complex instructions for taking the medication, and side effects (anticipated and/or experienced), particularly affecting the gastrointestinal region [9, 13, 14]. Moreover, dysphagia and swallowing difficulties have also been reported as affecting older people, further compromising long-term adherence [13].

Alternative treatment regimens, such as 3 monthly intravenous ibandronate and annual intravenous zoledronate infusions (also known as zoledronic acid) are available, and recent evidence suggests zoledronate may be more clinically effective [15], however patients' acceptability remains unclear.

Investigating people's adherence to bisphosphonate treatment regimens through the lens of acceptability, has not been extensively covered by research. Key findings from a recent systematic review [14] showed that during the integral process by which patients made sense of the medication, they weighed up concerns about treatment against perceived need, and prioritised evidence of treatment effectiveness. The authors identified that more research is needed to establish the extent to which intravenous bisphosphonates overcome issues related to treatment burden. Therefore, this paper aims to provide insight into the acceptability and engagement of both oral and intravenous bisphosphonate treatments for patients with osteoporosis who were at risk of fragility fractures.

Methods

With ethical approval (North West- Preston Research Ethics Committee (REF: 19/NW/0714), semi structured interviews were conducted between June 2020-August 2020, and in March 2021.

Theoretical framework

For the purposes of this paper, our definition of "acceptability" is based on Sekhon et al.'s (2017) framework [16], which proposes that it is a multi-faceted construct underpinned by seven key domains. These domains are collectively known as the Theoretical Framework of Acceptability (TFA) and their descriptive definitions are conveyed in Table 1.

(Please insert Table 1 here)

Our conceptual understanding of “engagement” aligns with the definitions proposed by Lindsey et al. and Staudt [17, 18] who suggest that it encompasses both attitudinal dimensions and behavioural dimensions. Collectively, acceptability and engagement in treatment regimens influence treatment adherence.

Sampling

The inclusion criteria for participating were adults who had taken or received bisphosphonates for the prevention of fragility fractures within the previous 24 months, and they needed to have capacity to provide informed consent. The purpose of the interviews was to explore patients’ experiences of bisphosphonate treatment regimens for the prevention of fragility fractures, focusing on which bisphosphonates were most acceptable to patients.

Originally, we planned to recruit participants via regional primary and secondary care clinicians and the regional Clinical Research Network. Due to Covid-19, recruitment methods were adapted; a study advertisement in the Summer 2020 edition of the Royal Osteoporosis Society newsletter invited individuals to take part in one telephone semi-structured interview. Replies were used as part of purposive sampling thus ensuring that the sample included enough participants who had experience of oral bisphosphonates, intravenous bisphosphonates, and those who had experience of both types of treatment. Once major Covid-19 restrictions had been lifted, the research team were able to engage with clinicians across the region, via professional networks, to support the recruitment of patients who were receiving intravenous bisphosphonates in the community. Such experiences were sought since community provision of intravenous bisphosphonates is not usual practice across the UK.

Data collection

Interview schedules for participants were developed in collaboration with the study team and steering group, which included Patient and Public Involvement and Engagement (PPI) representatives and comprised questions about patients' experiences of the osteoporosis diagnosis, perceptions about their bisphosphonate treatment regimen(s), and clinician and service factors. The interview schedule was piloted with two PPI representatives and refined as appropriate. All participants provided informed consent. All interviews were conducted over the telephone.

Data analysis

Interviews were digitally recorded, transcribed verbatim, and anonymised. The interview transcripts were uploaded to NVivo (version 12) and were subjected to intense open coding to identify early ideas and issues (referred to in NVivo as "nodes"). Two researchers independently coded the first five transcripts and then compared analyses, allowing interpretations of the data to be critically assessed, refined, and agreed. Once first level nodes had been agreed, the remaining transcripts were coded according to these by two researchers. Newer sub-nodes were added over time to enable specific and relevant issues to be categorised effectively. These sub-nodes were developed and agreed by two researchers. Once all the transcripts had been coded, the process of iterative categorization [19] was used to provide a clear and rigorous written trail reflecting the development of themes from initial nodes. This involved identifying key NVivo nodes as particularly pertinent to the research question [19] and exporting the content to Word. Table 2 describes these nodes and what aspect of the data they captured.

(Please insert Table 2 here)

Once exported into Word, the data that had been coded to each node were examined and systematically re-read. Summary and interpretive notes were added,

reflecting on the content of the theme in relation to other themes, research questions, and prior literature, notably the TFA [16]. The codes were then formally mapped to the TFA as a framework providing appropriate constructs to capture key dimensions of treatment acceptability and engagement.

Results

A total of 78 participants with a mean age of 69.9 years were recruited through the advertisement in the Royal Osteoporosis Society newsletter and through engagement with clinicians via professional networks. Forty-three patients had most recently taken oral bisphosphonates (for the majority of these participants, the current or most recent oral bisphosphonate that they had taken was alendronate tablets). Thirty-seven participants had most recently received intravenous zoledronate bisphosphonate infusions in hospital or community settings. Interviews ranged in duration from 20-60+ minutes. Table 3 provides an overview of participants' demographics.

(Please insert Table 3 here)

Patients' acceptability and engagement behaviours were captured through the TFA domains (Table 1).

The findings are discussed using examples from the data, with references to supporting quotations indicated in parentheses (see table 4). Participant identifiers at the end of each quote indicate the bisphosphonate treatment experience of the patient as follows:

- **O**= oral bisphosphonate treatments only (i.e., weekly alendronic acid tablets, weekly soluble alendronate, weekly risedronate tablets, or monthly ibandronate tablets;
- **IV**=Intravenous zoledronate bisphosphonate treatment only;

- **Dif**= experience of different types of bisphosphonate treatments (i.e., oral and intravenous bisphosphonates at different time points).

As shown in Table 3, some participants on “oral bisphosphonates only” took different forms of oral bisphosphonates at different points e.g., initially alendronate before being put on risedronate tablets.

(Please insert Table 4 here)

Intervention Coherence and Perceived Effectiveness

Although “intervention coherence” and “perceived effectiveness” are distinct constructs in the TFA, participants’ understanding of the way oral and intravenous bisphosphonate medication worked, and the extent to which these were perceived as effective were often closely related. Both involved developing a conception of the future risk posed by reducing bone density, and the potential reduction of such risk through taking the medication.

As bisphosphonates, regardless of type, do not necessarily address any felt symptoms, the coherence of the medication involved envisioning it as providing a level of protection from acute or chronic health problems associated with reduced bone strength. Many patients described treatment as a way of avoiding negative consequences from ongoing bone deterioration; these consequences were often most vivid for those who had personal experience of fractures or had seen a family member suffer (Quotations #1 and #2).

In some instances, patients felt they had sufficient support from their healthcare providers to understand this protection (Quotation #3). This was particularly the case where participants felt they had tangible evidence of the treatment working, for example positive results from bone density (DXA) scans, indicating improved T-scores, which drove them to continue taking the medication. A T-score is an indication of how close the person’s bone density is to the average peak bone

density (Quotation #4). Others described feeling motivated by the fact that they had not sustained fractures since beginning treatment and developed hope that treatment would maintain or improve their bone density (Quotation #5).

However, uncertainties about the purpose of bisphosphonate treatment were also very common; participants questioned the degree to which oral bisphosphonates in particular were working. Underpinning this, participants described a wide variability in the level of information, support, and/or feedback they were given from their healthcare providers. This included perceived limitations or contradictions in the way medication had been explained (Quotation #6) and perceived gaps in their care. Some taking oral bisphosphonate described disappointment at poor follow-up and lack of opportunities to discuss effectiveness, which left them uncertain as to whether the treatment was still appropriate (Quotation #7).

Patients receiving intravenous treatment generally had fewer concerns over effectiveness and coherence of the medication. This potentially resulted from this group having more regular scheduled appointments, and that the administration of the treatment required the presence of a healthcare professional. This enabled more opportunities for patients to interact with clinicians to discuss the reasons for taking the medication (Quotation #8). This was further enhanced when intravenous treatment was provided at home, with the nursing team able to focus exclusively on one patient for the duration of the treatment. This included opportunities to discuss effectiveness and the findings or previous scans (Quotation #9). Further, patients taking intravenous bisphosphonates also tended to have well-established timepoints for follow up (Quotation #10).

Moreover, a few patients associated the format of intravenous treatment as a ‘stronger’ treatment for osteoporosis compared to oral bisphosphonates (Quotation #11). While this might not have been an explicit message from health professionals, the intravenous treatment was often seen as a ‘step up’ in the intensity of care for

patients who had previously been taking oral bisphosphonates. In this context, a greater efficacy of intravenous treatment was seen to make sense.

Opportunity Costs and Burden

Although a small portion of patients who were taking, or who had taken, oral bisphosphonates found the regimen relatively straightforward when weighed against the benefits, a larger portion identified wide-ranging opportunity costs and burdens. Most commonly, patients described struggling with the general treatment routine which was regarded as complex and disruptive (Quotation #12). The common problems for patients taking oral bisphosphonates were the restrictions around not being able to eat straightaway and needing to remain upright. The latter was particularly challenging for patients who had previously suffered from fractures or other conditions which affected their posture (Quotation #13). Moreover, the requirement to follow strict instructions caused high levels of burden for some patients, to the extent that they felt that their mental wellbeing was compromised (Quotation #14). Some patients taking oral bisphosphonates described personal strategies to cope with these challenging aspects of the regimen, reducing costs and burdens. This included planning ahead, thinking positively, engaging with the Royal Osteoporosis Society, and setting reminders (Quotation #15).

In comparison with the costs and burdens of oral treatment, patients generally identified practical challenges and inconveniences relating to accessing intravenous bisphosphonate treatment, as opposed to the treatment per se. This included travelling to hospital appointments, issues around parking, and navigating one’s way around the hospital (Quotation #16). Such issues were largely removed for patients receiving intravenous treatment at home, for whom the work of administering the medication was taken up by their healthcare providers (Quotation #17), which was appreciated by participants. Having home-based intravenous treatment also enabled some patients to cope better with the regimen since they would have faced difficulties with travelling due to the physical restrictions caused by osteoporosis

and/or comorbidities (Quotation #18). It is worth noting that a small number of patients did comment on difficulties with the administration of intravenous treatment, e.g., having the needle inserted into the vein (Quotation #19). There were also some patients who felt happy with the oral bisphosphonate regimen, and a small number drew on points of comparison with the intravenous treatment to justify their preference (Quotation #20).

Regardless of treatment type, a regimen that led to no side effects or manageable side effects was perceived to be less burdensome with fewer opportunity costs, supporting acceptability and engagement (Quotation #21). But for patients where side effects were particularly severe, this was enough to cause them to stop engaging in the treatment (Quotation #22). For some patients who did not experience severe side effects, this did not preclude the worry that these could occur. Such concern was burdensome for some, whilst living with the risk of side effects was one of the costs of engaging in the treatment (Quotation #23). Patients also spoke about the smaller likelihood of particular side effects from intravenous treatment (Quotation #24), therefore identifying an additional desirable element of this particular regimen.

Ethicality

In the context of bisphosphonate treatment acceptability and engagement, the TFA domain of “ethicality” was linked to the extent to which patients regarded the treatment regimens as aligning with their individual values, and whether they perceived the treatment to be fair and suitable for their needs. This often related to the way in which they had come to be prescribed the treatment and the manner in which treatment was offered to them. For some patients who were prescribed alendronic acid tablets, they felt that their personal wishes for other options had been dismissed, which led to negative attitudes towards the treatment (Quotation #25). Even for patients who had come to accept any inconveniences of the oral bisphosphonate treatment regimen and were engaging in the treatment, many still expressed dissatisfaction with the fact that they had not been presented with other treatment options (Quotation #26).

However, other patients did not find it a problem that they had not been presented with alternative options, and in fact, this encouraged them to engage in the treatment (Quotation #27). Some patients receiving intravenous bisphosphonate treatment who had previously been taking oral bisphosphonates made direct comparisons between the regimens. Intravenous bisphosphonate treatment was generally viewed as having a more appropriate frequency and was a better fit with their daily living activities and responsibilities (Quotation #28). While this could be seen as pointing to the generally lower burden of intravenous treatment, it could also be identified that such comparisons played into overall perceptions of equity; namely it was more common for those receiving intravenous treatment to see themselves as being treated fairly.

Self-Efficacy and Affective Attitude

When patients were able to develop high levels of coherence around the treatment, they generally expressed positive affective attitudes towards treatment, including feelings of being secure and supported (Quotation #29). Moreover, when patients were able to develop confidence around effectiveness, even if this was just the prospect of the treatment doing their bone health some good, this also led to positive affective attitudes, including gratitude and hope (Quotation #30).

When patients perceived that they had been allocated treatment which had lower opportunity costs and burden, they described feeling privileged (Quotation #31). Furthermore, when speculatively comparing to oral bisphosphonates and weighing up the negatives against the positives, the intravenous treatment was often regarded as the better option, leading to feelings of satisfaction (Quotation #32). In addition, the ability to reflect on negative experiences of oral bisphosphonates led to patients conveying positive affective attitudes and feelings about intravenous treatment (Quotation #33). This demonstrates the impact of direct experience in the process of balancing perceptions around coherence and effectiveness against costs and burdens, and its effect on patients' attitudes towards treatment type.

However, despite curiosity about alternative treatments, when the experience of oral bisphosphonates had been unproblematic, patients described being happy to remain on their current regimen (Quotation #34). Moreover, regardless of treatment type, in circumstances where opportunity costs and burdens were low, patients expressed high levels of self-efficacy, sharing their confidence in being able to execute the necessary actions to partake in the treatment regimen (Quotation #35).

Sometimes, patients discussed the steps that were made to reduce the burden of undergoing treatment, and how such measures made them feel more positive and able to cope with the regimens, thus increasing self-efficacy. By nature of the oral bisphosphonate regimen, such strategies had to be instigated by the patients themselves. In contrast, for patients receiving intravenous treatment, it was often the healthcare staff who could facilitate a smooth and comfortable experience for them (Quotation #36). Also, when the treatment aligned with one's personal beliefs, this also led to positive affective attitudes, and higher levels of self-efficacy. Patients openly expressed their satisfaction when they believed that they were on the most appropriate treatment for the osteoporosis (Quotation #37). Some patients described positivity at being on what they perceived to be the right treatment, particularly if their experience of previous treatments had been negative (Quotation #38). Therefore, perceived fairness of treatment allocation, including the timing of this allocation, also impacted on affective attitudes.

Discussion

We have demonstrated how patients' acceptability and engagement in bisphosphonate treatment can be described and explained through the seven TFA domains [16]. Specifically, we describe how the balancing of specific TFA domains impacted on the extent to which patients with osteoporosis accepted and engaged in their treatment, manifesting as self-efficacy and affective attitude. By nature of treatment format, lower regularity of treatment, more established contact points and follow-up with healthcare professionals, intravenous bisphosphonate treatment was generally perceived to offer lower opportunity costs, be less burdensome, and was

often regarded as appropriate treatment by patients. This latter point was the case for some patients who had previous negative experiences with oral bisphosphonates. Moreover, there was often more opportunities to build up coherence around intravenous treatment and develop confidence around its effectiveness since such patients were more likely to have frequent contact with healthcare professionals, who could address patients' queries and explain details around the treatment on more than one occasion. In addition, DXA scans (bone density scans used to measure how much bone tissue an individual has, undertaken to help assess fracture risk) tended to be implemented at earlier points compared with patients taking oral bisphosphonates, thus providing a means to measure the success of treatment.

Crucially, TFA domains were found to be interconnected, with patients balancing treatment burden, opportunity costs and ethicality issues against treatment coherence and perceived effectiveness. The outcome of this balancing act ultimately determined patients' attitudes towards, and engagement in, their treatment regimens, thus informing their affective attitudes and self-efficacy. This is conveyed in Figure 1.

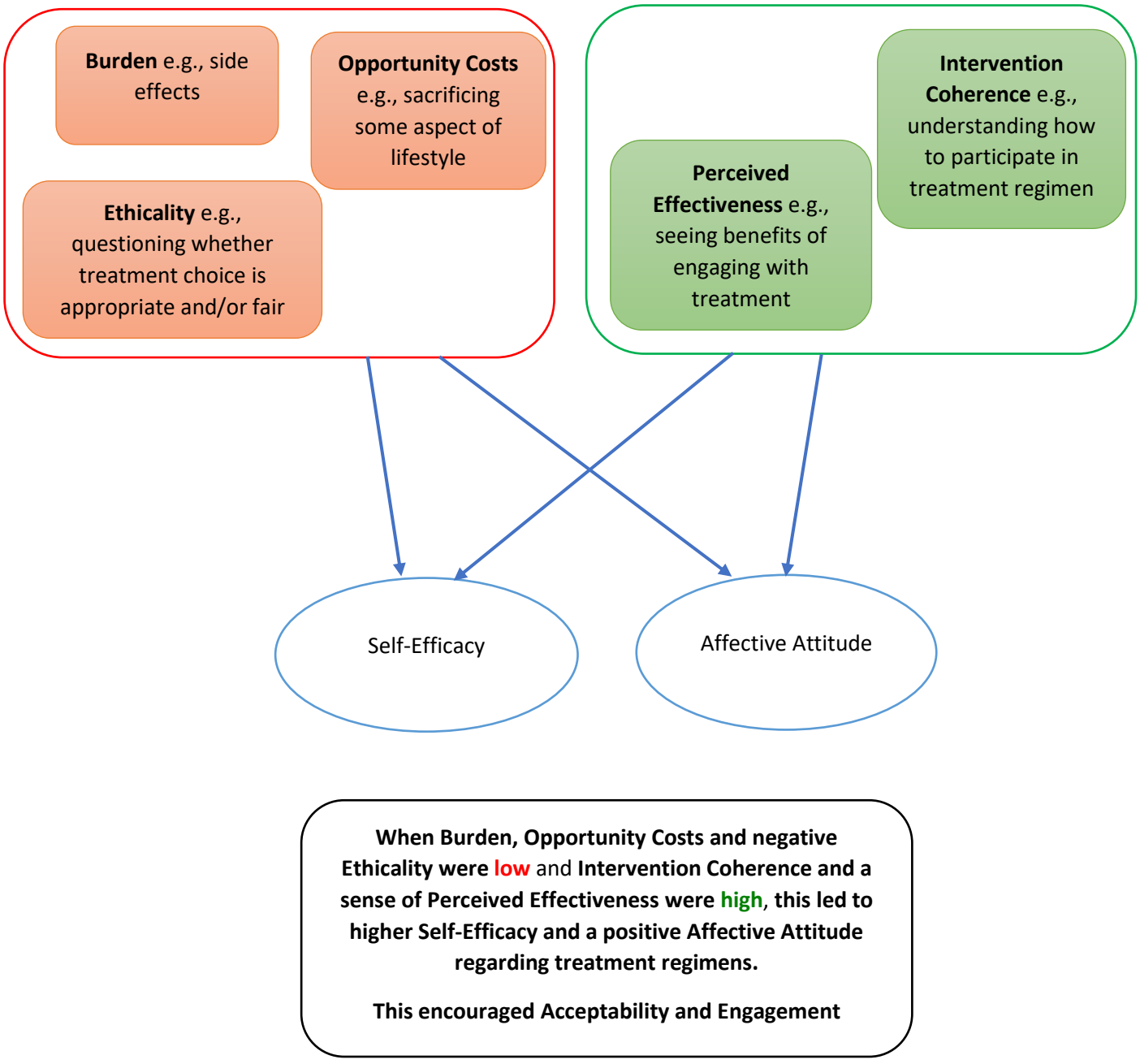

Figure 1: Relationship between TFA domains

Few studies have previously investigated patient acceptability and engagement for different bisphosphonate treatment regimens. Roh et al [20] investigated adherence to bisphosphonates amongst patients with limited health literacy. The study found that adherence rates were significantly higher amongst patients who were receiving quarterly intravenous bisphosphonates compared with those taking weekly oral bisphosphonates. Moreover, another study found that 65% of newly diagnosed

patients with osteoporosis preferred an annual infusion compared with weekly oral bisphosphonate treatment, and this preference was particularly apparent in patients with a higher perceived risk of future fractures [21]. This may suggest that patients have more confidence that intravenous bisphosphonate treatment will be more effective in reducing fracture risk. This certainly reflects the findings of the current study which highlighted that perceived effectiveness was a key factor in influencing self-efficacy and affective attitude, ultimately impacting on treatment acceptability and engagement.

Regarding specific patient groups, two studies [22, 23] identified that post-menopausal women with osteoporosis preferred treatments that occurred less frequently, citing such regimens as more comfortable, simpler, and enabling them to take fewer tablets [23]. This suggests that weekly oral bisphosphonates regimens are harder to adhere to for certain patient groups due to the frequency and perceived complexity. Furthermore, domiciliary treatment, such as intravenous drugs at home, may be more beneficial for older patients living with long-term conditions, due to the challenges associated with travelling to hospital appointments, including distance, reduced mobility, and pain, as highlighted by participants in our study and also in other studies [24, 25]. This could be seen as consistent with wider calls to shift aspects of services for chronic conditions away from acute facilities, although this shift remains an ongoing policy and funding challenge [26].

Despite the recognised challenges with taking oral bisphosphonate, there were clear examples in the current study where participants accepted and engaged with oral bisphosphonates when opportunity costs and burden levels were low. Similarly, a study investigating bisphosphonate treatments in women with breast cancer [27] confirmed that most participants had been able to accommodate oral bisphosphonate treatment into their lifestyle and were completely satisfied with treatment. This suggests that such regimens are not always burdensome for patients and that opportunity costs can be met. However, in the current study, there were patients who continued to engage amid difficult circumstances such as side effects which were burdensome, and where treatment had a significant impact on lifestyle.

In these cases, the TFA cannot account as strongly for such patients' experiences. Such patients may have prioritised the outcome of treatment (i.e., the hope of improved bone health and less fractures) more highly than the treatment experience, thus withstanding the negative aspects of treatment. The complexities of using the TFA in the context of examining treatment acceptability has been acknowledged by previous research. Paskins et al. [14] found that there were overlaps between TFA domains, and that it is not always a comprehensive framework for offering understanding into patient acceptability and engagement with medicines. Other frameworks such as the Necessity-Concerns Framework [28] may be helpful in understanding and transforming adherence-related beliefs and behaviours. This framework understands patients' adherence to be the outcome of a cost-benefit analysis whereby adherence is likely to be higher when the perceived need for treatment is prioritised over the risk of negative consequences such as side effects. This lens may be relevant to understanding some patients in our sample who pursued treatment amid high burden levels and significant opportunity costs.

Strengths and limitations

A key strength of this study is the fact that a large sample of participants were recruited to provide in-depth insight into different experiences of bisphosphonate treatment regimens. The main limitation is that findings were largely drawn from a sample of participants who had membership with the Royal Osteoporosis Society, with a smaller number recruited through NHS services. This may have caused the sample to be biased, e.g., it may have largely comprised individuals who had the financial means to fund membership, and who were possibly taking a more proactive approach to their health by investing in resources. This could suggest that the sample included individuals who were more engaged in health seeking behaviour, and as such, were more likely to actively search for strategies to maintain better health, including connecting with the Royal Osteoporosis Society. This may restrict applicability to other patient groups, such as those who are financially disadvantaged and those less proactive in their care and treatment. It is also possible that the sample may have consisted of individuals who had higher health literacy, thus excluding those who do not have the appropriate skills, knowledge, understanding

and confidence to access and understand health information, such as those provided by the Royal Osteoporosis Society. Moreover, our sample of patients receiving intravenous bisphosphonates comprised those receiving zoledronic acid only and not three-monthly ibandronate treatment. However, the findings do appear to fit with previous qualitative studies exploring reasons for non-adherence to oral bisphosphonates. Further the paper demonstrates the relevance of TFA domains in explaining attitudes and behaviours around acceptability and engagement in bisphosphonate treatment regimens. Utilising the TFA domains to explain acceptability and engagement of intravenous bisphosphonate treatments is particularly novel. It will be useful to explore whether such findings apply to other patient groups.

The study has identified several questions for further research, including whether it would be feasible and appropriate to offer specific patients first-line intravenous zoledronic acid treatment for osteoporosis, and how acceptability and engagement can be optimised. In addition, it has also highlighted the possibility of treating long-term conditions in alternative ways, such as in the community, which may be favourable for an ageing population, where hospital travel may be challenging due to co-morbidities and the Covid-19 pandemic. These uncertainties will feed into a research priority setting exercise alongside other questions which have arisen from the wider research study programme.

Conclusion

Intravenous bisphosphonate treatment was generally more acceptable to patients. Such regimens were perceived to be more straightforward to engage in, although a portion of patients taking oral bisphosphonates were satisfied with their current treatment. The TFA was a useful model in accounting for how patients accept and engage in bisphosphonate treatments but was limited as a comprehensive framework that could explain all patient experiences. Further research is needed to identify whether findings apply across other patient groups, how acceptability and engagement can be optimised, and to identify other frameworks for investigating patient acceptability of, and engagement in, bisphosphonate treatment regimens.

Key points

- Improving long-term adherence with fracture prevention bisphosphonate treatments is encouraged, but adherence rates for first line oral bisphosphonate alendronate treatment remains low.
- Understanding patient acceptability of alternative bisphosphonate regimens, such as annual intravenous infusions is important to ensure optimal treatment benefits.
- This qualitative interview study identified that annual intravenous zoledronate bisphosphonate treatment was generally more acceptable to patients, perceived as more straightforward to engage in.
- Implications for research and clinical care include the feasibility of offering some patients first-line intravenous zoledronate treatment for osteoporosis.

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