

## Can new information and communication technologies help in the management of osteoporosis?

“It is a considerable challenge for healthcare systems to ensure adequate resources to support individuals with chronic diseases and encourage them to assiduously follow their treatment.”

**Keywords:** GP's awareness • internet • new information and communication technologies • osteoporosis • patient's knowledge • treatment compliance

Osteoporosis is a serious public health issue and a major cause of bone fracture worldwide. These fractures are associated with major risk of morbidity such as chronic pain or long term disability, early mortality and higher healthcare costs [1]. Three important issues are in the way of the management of osteoporosis.

First is population awareness regarding osteoporosis prevention and self-management. Among all risk factors for osteoporosis and fractures, some are modifiable such as smoking, high alcohol intake or low physical activity level [2]. However, population knowledge around osteoporosis is limited, even among diagnosed patients [3]. A better knowledge of modifiable risk factors of osteoporosis as well as the importance of good life habits may have an impact on osteoporosis burden.

Second is treatment compliance. A recent decrease in the incidence of fracture has been reported in some countries. Interestingly, this has coincided with an increased use of osteoporosis treatments in these countries [4]. Even if there is no clear causal relationship between this increased use of osteoporosis medications and the decreased rate of hip fracture, this fact underlines the importance of the pharmacological management of osteoporosis. In addition, several studies have shown that a greater adherence to osteoporosis medication can reduce the number of

fractures [4–6]. Compliance to medication for chronic diseases typically ranges from 50 to 60% and it is usually lower when the disease is asymptomatic as in osteoporosis. Weycker *et al.* showed that the overall risk of adherence failure was 47% at 3 months, 70% at 1 year and 84% at 3 years [7]. These numbers may vary according to the drug considered but they are comparable for all therapies. Our team has shown that at the end of the first year of therapy, only 39.45% of women continued to take their medication [8]. We showed that the relative risk reduction for hip fracture was 60% ( $p < 0.0001$ ) for persistent compared to nonpersistent patients. In fact, and because of poor compliance, a large majority of women are not adequately protected against fracture [7], which continues to generate costs [9]. It is a considerable challenge for healthcare systems to ensure adequate resources to support individuals with chronic diseases and encourage them to assiduously follow their treatment [5]. Promoting interventions that could improve adherence is worthwhile and may reduce the rate of osteoporosis as well as the related complications [8].

Finally is awareness among general practitioners (GPs) regarding the disease. In a recent study, GPs were not particularly concerned about osteoporosis in their patients or in the general population. They seem to rank diabetes, osteoarthritis, cardiovascular



**Justine Slomian**

Author for correspondence:  
Department of Public Health,  
Epidemiology & Health  
Economics, University of  
Liège, Belgium  
Support Unit in  
Epidemiology & Biostatistics,  
University of Liège, Belgium  
jslomian@ulg.ac.be

**Geoffrey Appelboom**

Neurodigital Laboratory,  
Columbia University, NY,  
USA

**Olivier Ethgen**

Department of Public Health,  
Epidemiology & Health  
Economics, University of  
Liège, Belgium

**Jean-Yves Reginster**

Department of Public Health,  
Epidemiology & Health  
Economics, University of  
Liège, Belgium  
and  
Support Unit in  
Epidemiology & Biostatistics,  
University of Liège, Belgium

**Olivier Bruyère**

Department of Public Health,  
Epidemiology & Health  
Economics, University of  
Liège, Belgium  
and  
Support Unit in  
Epidemiology & Biostatistics,  
University of Liège, Belgium

diseases and hypertension as higher medical concerns than osteoporosis [10]. The lack of awareness among GP leads to under prioritization of this disease and the education related to it.

Nowadays, the internet has become one of the most important means by which to obtain health and medical information (e.g., physical activity [11]). It is often the first step in checking for basic information about a disease and its treatment. In addition, innovations in mobile and electronic healthcare are revolutionizing the involvement of both doctors and patients in the modern healthcare system. It creates new opportunities for individuals to participate actively in monitoring and improving their health [12]. A number of studies have underlined that a well-informed patient is more likely to participate in healthy behaviors and to better manage their conditions. As a result, patients would enjoy a better quality of life and would seek less medical attention from their doctors. There have been many encouraging studies using mobile phone, SMS, social networks, email or the internet in the field of diabetes, obesity, cardiovascular health, neurological function, physical therapy and rehabilitation. In the field of osteoporosis, these technologies could help and potentially address the three main issues discussed above.

**“A number of studies have underlined that a well-informed patient is more likely to participate in healthy behaviors and to better manage their conditions.”**

For osteoporosis awareness the internet provides a lot of information regarding risk factors, prevention and treatment of osteoporosis. Interestingly, a study showed that among women eligible for osteoporosis screening, approximately 80% reported having access to the internet, and 70% indicated they were likely to use the internet for health-related information gathering [13]. The same study also highlighted that while 65% of respondents indicated they would be likely to read about osteoporosis on a dedicated website, approximately half reported they might use the website for more interactive disease management activities. From an early prevention point of view, another study showed that an interactive educational website is an effective method for increasing awareness and understanding of osteoporosis in high school students [14]. In addition, many menopausal women already use the internet for personal research regarding their health: searching for information after consulting their physician, using YouTube to access information about pelvic floor exercises, asking questions about gynecological problems, bladder pain, breast or cervical cancer, among others. There also exist

a lot of chat rooms and social networks where women can speak about their problems, especially at the time of menopause. Unfortunately, the content and quality of websites, sometimes of unknown sources, concerning the prevention and the treatment of osteoporosis are highly variable and could be biased. Therefore, patients who access websites for information regarding osteoporosis should do very cautiously and should be willing to discuss results with their healthcare providers. Moreover, it is necessary to increase the number of resources, with rigorous language that is understandable for consumers. With regards to new mobile devices, recent studies have examined these technologies in the field of osteoporosis. For instance, Asakawa *et al.* have assessed an intervention consisting of sending emails to promote calcium intake and physical activity over 6 months for women aged 18–25 years [15]. The intervention group had a significantly increased calcium intake and did more exercise compared to the control group. Another study compared a group who had access to a structured hip fracture prevention website for older adults with a control group who only had access to conventional websites [16]. Both groups showed significant improvement in most outcomes (knowledge, self-efficacy and exercise). However, an improvement in calcium intake and satisfaction was only observed in the intervention group. A third study randomized 121 women to receive either personalized internet-based tutorials with behavior modification strategies or standard information [17]. The intervention group significantly increased general osteoporosis and calcium awareness and knowledge compared with the control group. Nevertheless, participants from the intervention group were not significantly more likely to meet recommendations for behavior changes. However, later analyses showed that participants desired more information to learn exercises, especially in the form of videos or illustrations. They also reported that they would be motivated by testimonials with participant success stories. Therefore, we can suggest that tailored strategies may improve knowledge and ability to meet health recommendations in women with or without osteoporosis.

Regarding compliance with pharmacological and nonpharmacological treatment, to the best of our knowledge, few studies have assessed the contribution of new information and communication technologies in adherence to treatment of osteoporosis. However, the few published studies reported conflicting results. Recently, a study compared two groups of patients (active and passive training). A bisphosphonate usage guide and an osteoporosis training booklets were given to all patients. The active training group had additionally received four telephone calls to remind them to read the booklets and participate in four interac-

tive meetings. However, no significant difference was found in terms of treatment compliance between the two groups [18].

“...caregivers need to better understand information and communication technologies because they are becoming more widespread and could become a powerful tool of help in the healthcare process.”

Finally, regarding the attitudes of the GP to osteoporosis, it is well known that internet-based lectures are a popular means of disseminating medical knowledge; it has been shown that physician knowledge can increase after a single online osteoporosis lecture, but without significant change in patient care [19]. In this study, no patients who met age-specific screening guidelines were referred for dual energy x-ray absorptiometry, either before or after the single online osteoporosis lecture. In the USA, the American Board of Internal Medicine introduced internet-based self-evaluation tools called practice improvement modules. These are internet-based self-assessment modules that physicians use to improve performance on one targeted measure. With the use of the osteoporosis practice improvement modules, physicians reported, on average, significant and large increases in performance on measures targeted for improvement [20]. More studies investigating the potential effect of new information and communi-

cation technologies to improve osteoporosis management by general practitioners or specialists should be performed.

The use of these new information and communication technologies by patients could be interpreted either as a resource promoting their independence and empowerment or as a source of disturbance in the doctor–patient relationship. However, this is not how we should perceive it: caregivers need to better understand information and communication technologies because they are becoming more widespread and could become a powerful tool of help in the healthcare process. As women want to be better informed about their health, employing these technologies (e.g., social networks) could potentially be a good solution for the general management of osteoporosis. At this time, only a handful of studies have been published in this field but some ongoing clinical trials will hopefully provide exciting new evidence in a near future.

#### Financial & competing interests disclosure

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

No writing assistance was utilized in the production of this manuscript.

#### References

- 1 Kanis JA, McCloskey EV, Johansson H, Cooper C, Rizzoli R, Reginster JY. European guidance for the diagnosis and management of osteoporosis in postmenopausal women. *Osteoporos Int.* 24(1), 23–57 (2013).
- 2 Kanis JA, Oden A, Johnell O *et al.* The use of clinical risk factors enhances the performance of BMD in the prediction of hip and osteoporotic fractures in men and women. *Osteoporos Int.* 18(8), 1033–1046 (2007).
- 3 Costa-Paiva L, Gomes DC, Morais SS, Pedro AO, Pinto-Neto AM. Knowledge about osteoporosis in postmenopausal women undergoing antiresorptive treatment. *Maturitas* 69(1), 81–85 (2011).
- 4 Hiligsmann M, Kanis JA, Compston J *et al.* Health technology assessment in osteoporosis. *Calcif. Tissue Int.* 93(1), 1–14 (2013).
- 5 Huybrechts KF, Ishak KJ, Caro JJ. Assessment of compliance with osteoporosis treatment and its consequences in a managed care population. *Bone* 38(6), 922–928 (2006).
- 6 Cotte FE, Mercier F, De Pourville G. Relationship between compliance and persistence with osteoporosis medications and fracture risk in primary health care in France: a retrospective case–control analysis. *Clin. Ther.* 30(12), 2410–2422 (2008).
- 7 Weycker D, Macarios D, Edelsberg J, Oster G. Compliance with drug therapy for postmenopausal osteoporosis. *Osteoporos Int.* 17(11), 1645–1652 (2006).
- 8 Rabenda V, Mertens R, Fabri V *et al.* Adherence to bisphosphonates therapy and hip fracture risk in osteoporotic women. *Osteoporos Int.* 19(6), 811–818 (2008).
- 9 Rabenda V, Reginster JY. Overcoming problems with adherence to osteoporosis medication. *Exp. Rev. Pharmacoecon. Outcomes Res.* 10(6), 677–689 (2010).
- 10 Otmar R, Reventlow SD, Nicholson GC, Kotowicz MA, Pasco JA. General medical practitioners' knowledge and beliefs about osteoporosis and its investigation and management. *Arch. Osteoporos.* 7(1–2), 107–114 (2012).
- 11 Mouton A, Cloes M. Web-based interventions to promote physical activity by older adults: promising perspectives for a public health challenge. *Arch. Public Health* 71(1), 16 (2013).
- 12 Appelboom G, Yang AH, Christophe BR *et al.* The promise of wearable activity sensors to define patient recovery. *J. Clin. Neurosci.* pii, S0967-5868(13)00647-4 (2013).
- 13 Rozenfeld Y, Johnson T, Klug C. Assessing interest in an osteoporosis website: a survey among women eligible for osteoporosis screening. *Osteoporos Int.* 21(7), 1197–1204 (2010).

- 14 Randi Schoenfeld E, Ng P, Henderson K, Wu SY. Using the internet to educate adolescents about osteoporosis: application of a tailored web-education system. *Health Promot. Pract.* 11(1), 104–111 (2010).
- 15 Asakawa K, Koyama K, Yamagata Z. Effect of educational intervention using the Internet on quantitative ultrasound parameters in prevention of osteoporosis: a randomized controlled trial in young Japanese women. *Int. J. Womens Health* 3, 415–422 (2011).
- 16 Nahm ES, Barker B, Resnick B, Covington B, Magaziner J, Brennan PF. Effects of a social cognitive theory-based hip fracture prevention web site for older adults. *Comput. Inform. Nurs.* 28(6), 371–379 (2010).
- 17 Drieling RL, Ma J, Thiyagarajan S, Stafford RS. An Internet-based osteoporotic fracture risk program: effect on knowledge, attitudes, and behaviors. *J. Womens Health (Larchmt.)* 20(12), 1895–1907 (2011).
- 18 Tuzun S, Akyuz G, Eskiuyurt N *et al.* Impact of the training on the compliance and persistence of weekly bisphosphonate treatment in postmenopausal osteoporosis: a randomized controlled study. *Int. J. Med. Sci.* 10(13), 1880–1887 (2013).
- 19 Hansen KE, Rosenblatt ER, Gjerde CL, Crowe ME. Can an online osteoporosis lecture increase physician knowledge and improve patient care? *J. Clin. Densitom.* 10(1), 10–20 (2007).
- 20 Hess BJ, Johnston MM, Iobst WF, Lipner RS. Practice-based learning can improve osteoporosis care. *J. Am. Geriatr. Soc.* 61(10), 1651–1660 (2013).