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THE ICELANDIC EXPERIENCE OF A CLINICAL DECISION SUPPORT SYSTEM FOR THE MANAGEMENT OF OSTEOPOROSIS

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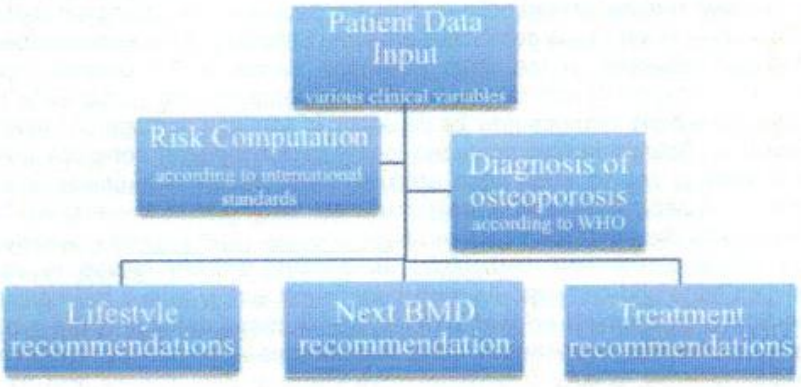
Background: Physicians use their experience, knowledge and patient data to analyze and give their patients optimal medical care. However, in modern times the medical knowledge is expending enormously, including in the field of osteoporosis. Thus, potential risk of medical errors in daily clinical praxis is growing. To overcome this, aid from digital computerized system can offer better management of complicated medical cases.

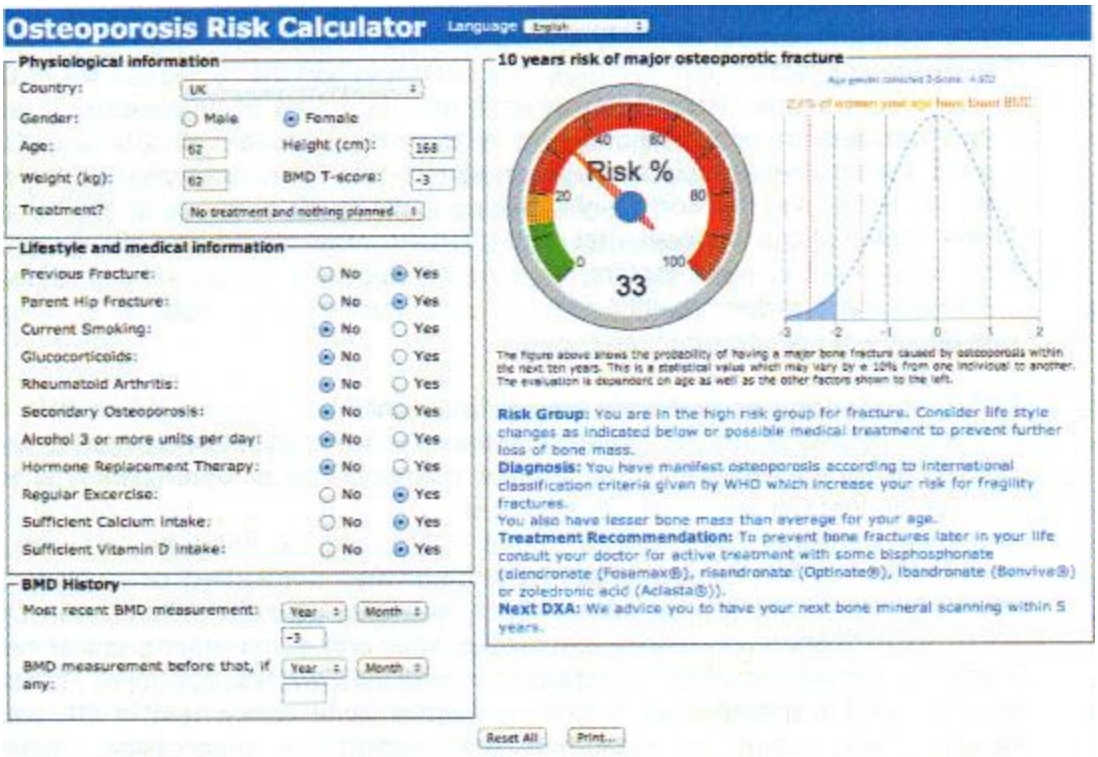
Currently available risk calculator systems for osteoporosis: e.g. FRAX®, Garvan® and Qfracture®, provide the user with a ten-year probability of fragility fracture. While this information may be useful it is not immediately evident for the non-expert user how this information can be translated into patient driven therapeutic decision-making.

The primary aim of the present project was to build a clinical decision support system (C-DSS) focusing on the medical care of osteoporosis containing fracture risk assessment and targeted individualized treatment options supported by international guidelines and evidence based medicine.



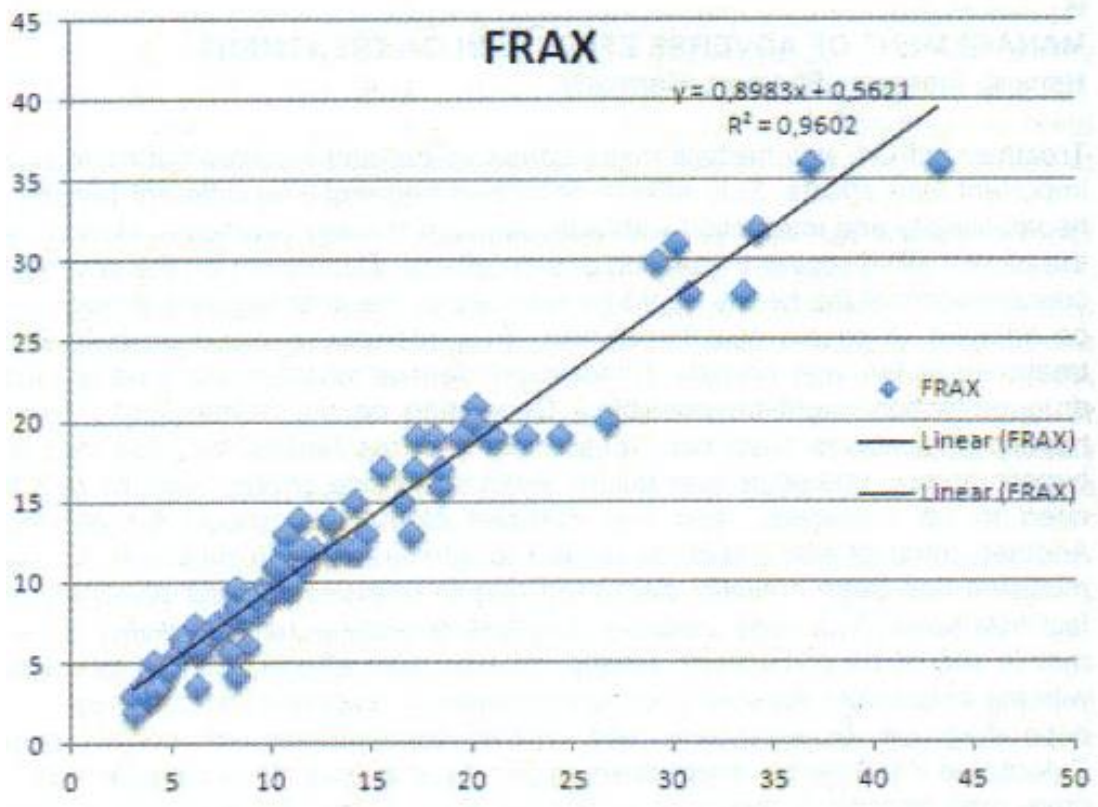
The osteoporosis advisor (OPAD) is a C-DSS expert system that gives 10 years fracture risk for the individual patient, lifestyle recommendations, recommendations of whether and when BMD scan is warranted and furthermore, the system will identify patients at risk for osteoporosis related fractures and are in need of specific individualized preventive medical treatment. The design of the system was driven through a knowledge mapping approach.

Methods: The project utilizes ready to use software products to capture clinical information from international guidelines and view from an experts in the field of osteoporosis. A panel of experts further verified the models predictions and recommendations in a systematic review manner.



The OPAD provides physicians with a Web based user interface in order for them to insert standard patient data. The interactive web enabled C-DSS then processes the input and provides instant diagnostic comments, 10-years risk of major fragility fracture and treatment options for the given case. In addition, it recommends when and whether a next DXA evaluation should be performed. Furthermore, in highly complicated cases, the Expeda OPAD C-DSS will recommend further evaluation by specialist in the field of osteoporosis. Thus, standardizes the medical decision making according to best knowledge at every time.

Results: 308 individuals (87% females) with a mean age of 61 year (15-89) were evaluated with the OPAD and compared to FRAX for four countries.


FRAX
y = 0,8983x + 0,5621
R² = 0,9602
FRAX
Linear (FRAX)
Linear (FRAX)
0
5
10
15
20
25
30
35
40
45
50

The 10-years risk of major fracture calculated by Expeda C-DSS correlated strongly to all countries[7] tested with and without information of the T-value at the hip obtained by DXA: Sweden: 0,972 (R^2 value) and 0,950; Denmark: 0,980 and 0,959; Norway 0,971 and 0,953; USA Caucasians: 0,974 and 0,9525.

To evaluate the effectiveness of our system for deciding on the time until the next DXA scan, we selected a set of 94 consecutive individuals who were measured for bone mineral density in an outpatient hospital osteoporosis clinic at the Regional Hospital in Akureyri, Iceland. In only 48% of the group did the OPAD system recommend DXA evaluation at the present time, i.e. almost every other patient that underwent DXA did not gain additional information for risk evaluation for fragility fracture. In only three of these cases did the OPAD system change the given recommendation after DXA. Hence, individuals recommended by the OPAD system to have a BMD measurement are significantly more likely to subsequently receive recommendation for further treatment than those not recommended to have a BMD measurement (p-value 7.8e-9, Fisher exact test).

We ran similar test at the Osteoporosis unit at the University Hospital in Reykjavik for 308 cases, there lower fraction of patients (36%) were not recommended to have had DXA at the given time according to the OPAD. Only in 5.9% of the cases the treatment recommendations by OPAD changed after the DXA evaluation.

The outcome recommendations from the OPAD system were next compared with written recommendations given by a specialist in endocrinology and osteoporosis in a blinded fashion. The comparison of the recommendations given by the C-DSS in these 308 cases at the osteoporosis unit in Reykjavik and blinded independent expert on ostology, demonstrated that treatment recommendation were given in 31% of the cases by both readers. In 51% of cases the Expeda C-DSS recommended no further action necessary to be taken, while the expert gave that opinion in a 66% of the cases. Meanwhile, further consultations by the expert were given only in 3% of the cases but 19% by the Expeda system. Thus, as could be expected the consulting expert physician having various other detailed medical information at hand was more selective than the OPAD system in identifying patients for further osteoporosis evaluation.

The Expeda system always gives primary prevention recommendations if not already taken by the patient, while this is only given in few of the expert answers. Which, hopefully increase the awareness among health care takers for primary osteoporosis prevention measurement in context to public health.

Discussion: Osteoporosis fragility fractures lead to a debilitating outcome for those affected leading to a significant negative impact on not only their quality of life but also individual life expectancy. Despite an effective drug treatment being readily available, it has been recognized that majority of individuals at risk go unnoticed and therefore miss potentially lifesaving therapeutic measures. Thus, even patients who have suffered fragility fractures and have been exposed to the healthcare system are not identified and treated. In this context, if correctly implemented C-DSS such as the one presented here have the potential to improve both public and healthcare workers awareness of osteoporosis.

The access to DXA-machines is limited in most countries; therefore, it is important to find those that benefit most from DXA-evaluation, which would improve the cost efficiency of the diagnostic procedure.

The busy clinician may have difficulties to interpret the risk value figure for each patient in the hectic daily clinical praxis. Thus, we believe C-DSS, such as the OPAD presented here, will become a welcoming tool in identifying those at risk for osteoporosis fractures and promoting individualized best of care treatment in a highly cost effective manner.

Conclusion: The OPAD is highly accurate and according to the data presented here could become a valuable and cost effective decision diagnostic decision tool. This is particularly relevant when current international guidelines regarding osteoporosis population screening protocols are kept in mind. Future development of the system will include additional findings such as other radiological findings regarding vertebral compression fractures, specific genetic risk factors and various other biomarkers, that can be easily incorporated into our model structure. Thus, hopefully further enhance our understanding of osteoporosis fracture risk