

Technical Report 3

Dual Energy X-ray Absorptiometry (DXA) Services in Ireland. How do we fare?

National Survey of Services in Ireland (October – December 2006)

Technical report to NCAOP/HSE/DOHC

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Summary

The clinical significance of osteoporosis lies in the fractures that arise and their attendant morbidity and mortality. Measurements of bone mineral density (BMD) by Dual energy X-ray Absorptiometry (DXA) are central to the diagnosis and assessment of osteoporosis. Given a prevalence of osteoporosis of $\frac{1}{3}$ women and $\frac{1}{5}$ men over 50 years of age¹, with the associated risk of fractures, DXA service provision is a core health service, the delivery of which should be in a planned manner.

In 1998 the European Commission recommended that access to bone densitometry should be universal for people with accepted clinical indicators.¹ Kanis in 2003 compared DXA needs of various European countries to their current supply.² Figures for Ireland were not available.

This Irish survey addresses the information deficit as well as providing a baseline view of current DXA services in Ireland. 61 DXA scanners (59 locations) were identified. 59 were staffed, of which 53 (89%) participated in the survey. Based on the population of each hospital network, the DXA machine density ranged from 1/46,000 to 1/122,000. The annual number of scans per 100,000 population ranged from 1,025 to 3,053 (approximately).

Twenty-two (37%) of the DXA locations were in Public Hospitals, 15 (25%) were in Primary Care.

Nine (15.5%) were free to all patients, 36 (61%) charged all, the remainder were mixed, in that there were criteria for charging in some cases. The number of DXA services which were free to all users across the Networks ranged from 0 to 3, while of those with a mixture of free to charge the percentage varied from 10:90 to 40:60.

Only five of the 22 Public Hospitals provided 10 scan sessions per week – worked to full capacity. 19 scanners had waiting times of more than two weeks, 18 of these were in Public Hospitals. This ranged from 2-52 weeks with a median of 16 weeks.

The services provided ranged from providing a scan only, to providing a full clinical work up and treatment.

The scan report varied from scanner print-out to interpretation with respect to risk factors and advice on therapy.

The majority of DXA operators routinely scanned the spine. Almost equal numbers scanned one or two hip sites.

60% had written protocols in place. All had a procedure in place if daily quality control (QC) failed.

There were wide variations in training and continuous professional development (CPD) both in terms of content, quality and frequency, aspects of which were recurrent concerns in comments received.

Recurrent themes were evident in the comments of which there were over 250.

Kanis et al ² in their survey reported wide variables in the availability of DXAs in European countries. Like Kanis² this survey suggests inequity in terms of geography, waiting time, cost and access to DXAs.

In addition to accessibility to DXAs to meet the needs of patients with known risk factors, the requirements are for quality DXA services. At national level standards are needed to ensure such a quality service both in terms of protocols and guidelines in line with best international practice and to facilitate audit both of the DXA service itself, and the wider aspects of who is scanned, what happens those who are scanned and to ensure that those who should be scanned are actually scanned.

Respondents identified the need for recognised Irish standardised training and updates for DXA providers and for the wider aspects of the osteoporosis service available at national and regional level.

A number of recommendations are made, the implementation of which, are needed to address current deficits in the service.

Recommendations

This report addresses issues around DXA services in Ireland. However, there is an overlap with the wider area of osteoporosis, assessment and treatment. DXA services should be part of a multi-disciplinary osteoporosis service from assessment to management.

Public Awareness:

- The public require ongoing evaluated sources of information on bone health so that those with risk factors can seek appropriate assessment including DXA which would reduce requests for DXA from those at low risk.
- Ongoing supplies of information on all aspects of bone health including DXAs should be available in public areas such as libraries and also in all health care settings including DXA waiting areas. The quantity and frequency of delivery to latter areas should be based on numbers is attendance.

National bone health office:

A National bone health office with a small number of staff is recommended. The staff would provide and source expertise, act as conduit for developments, and highlight trends and issues. Such an office with regional and local networks could greatly facilitate progression of the following items:

- Regulations regarding the running of DXA scan units are needed at national level
- A National office could help harmonize policies on all aspects of BMD and DXA Testing
- The above would include issues of indications for repeat scans.

- The development of guidelines, standards and protocols in the field of DXAs is a continuous work in progress. The national office could be a conduit for these developments and their implications for those working in the area.
- A national office is needed to resolve issues of self referrals. Most centres do not accept such referrals but there is an issue of need for those patients who know themselves to be at high risk but who are not referred.
- On a related issue, a national office is needed to resolve the issue of liability and responsibility where a patient attends a doctor with the result of a DXA scan which that doctor did not request.

Equity & Charges:

- As a minimum a DXA scan, which is an important preventive service should be free to those in risk groups – all are entitled to free hospital services. If this needs to be introduced on a phased basis, initially all those with medical cards in high risk groups should be offered an accessible service.
- At the same time, as is evident from Table 2, each Network needs to ensure that a free service is available for those in their catchment population with risk factors.
- DXA scans for high risk patients should be covered by all health insurers.
- DXA scans should be located where they are accessible to those who require the service. In this regard cost and distance to travel for a service are key factors (in the UK the maximum distance suggested is 20 miles), as are waiting times, availability and ability to use transport. In the case where a public service is not available but where there is a private provider, the service should be bought under contract for the relevant high-risk patients. Such contracts should include details for follow-up scans.

Planning, Funding & Establishing a DXA service:

- The acquisition of a DXA machine should be part of a planned service development which includes allocation of staff, their training on DXA scanners and plans for their ongoing updates. It is not recommended that scanners are acquired without provision for staff allocation, nor is it recommended that scanners are acquired where arrangements are not also made for all relevant staff to train on its use. Relying on charities or pharmaceutical companies to fund and staff DXA services on an ongoing basis does not facilitate planned service development.
- Given the prevalence of osteoporosis, the risk of fractures and their consequences for the person and the health services, all tertiary / regional hospitals and acute public hospitals should have DXA scanners (compared with 15 from this survey) in addition to other specialist public hospitals (Table 3).

- Sufficient DXA sessions, at least a maximum of 10 per week, should be scheduled in public facilities to meet predicted needs of that catchment area (versus the 5/21 scanners in 20 public hospitals in this survey). This will involve providing a dedicated DXA scan area and sufficient staff. The cost of this and of ensuring waiting times are minimum will be offset in terms of fractures prevented.
- The wide variation and inequity between hospital networks in terms of scan sessions in public facilities (Table 4) needs to be addressed as a matter of urgency.
- Where an acute public hospital cannot provide sufficient DXA scans for its catchment population, the option of buying the service from local private providers should be explored as a short-term measure for specific high-risk patients.
- This will not obviate the advantage offered by having DXAs in some primary care settings. These facilitate patient lists being systematically gone through to identify those with risk factors and scanning as appropriate either within primary care or via local public hospital. Primary care settings have the advantages of being local and integrating all of a patient's care.

Service & Staff:

- DXA service should be part of whole bone health/osteoporosis service where all with risk factors regardless of financial circumstances or geographic location should get assessment, follow-up and appropriate multi-disciplinary management.
- Comprehensive bone health programme requires input from multi-disciplinary skills and teams, the number of which should be based on need.
- Included here is the need for every fracture clinic to have either a Fracture Liaison nurse or Osteoporosis nurse in attendance.
- Each public hospital should have a named Consultant who takes a lead in co-ordinating bone health issues in that hospital.

Patients:

- The majority of those at high risk of osteoporosis and fractures are known to the health service in the sense that they are attending hospitals and GPs. As a matter of good practice, at each LHO level each GP practice list should be reviewed and those with clinical risk factors identified and offered appropriate assessment.
- Likewise at each Hospital Network level, those currently attending high risk specialities such as Orthopaedics, Gynaecology, Endocrinology, Oncology,

Geriatrics, Gastroenterology, Respiratory etc should be reviewed and those with clinical risk factors identified and offered appropriate assessment.

- Those aged less than 20 years of age should only be scanned using suitable software, by operators trained in its use and where the person reporting has experience in the area.
- To move from the current situation where in a number of instances, software for those aged 20 years and over is also being used for the younger age group, at a minimum in each Network area at least one public facility should provide this service.

Audit:

At national / regional / local level, a fracture register, linked with specified minimum data set and standardised method of collection should identify:

- all patients with fragility fractures including details of referral for osteoporosis assessment including DXA results
- for each person presenting with a fracture, details of past fracture history and action taken to rule out osteoporosis.
- All DXA providers should audit their service on an ongoing basis, both the technical aspects and also wider aspects including feedback on what happens for the patient after their scan, on the return to their referrer etc.

Training and Continuing Professional Development (CPD):

- For a quality safe service, all involved in the service, regardless of location, should have appropriate regular ring fenced training and updates.
- All those operating DXA scanners and reporting scans should have documented training in radiation protection, on bone densitometry, on DXA machinery and at least the basics of osteoporosis and client risk factors.
- Documented CPD updates on each of these should be available for each staff member at least every second year.
- It was evident from this survey that apart from radiation protection training and to some degree manufacturers' training, it was difficult to assess the training of staff in each DXA unit. Many had attended National Osteoporosis Society or similar Irish courses. A smaller number had relevant certificates in the area. At a national level recognised certified courses, with updates supported by the HSE, needs to be developed, provided, evaluated and rolled out regionally on a periodic basis.
- A central repository of training information, standards and guidelines for all health care workers involved in the service should be developed.
- Each operator should scan a specified minimum number of people per year – this number should be set at national level and be sufficient to maintain skills.

- At national / regional / local level participation in an electronic CPD forum should be encouraged.
- Regional / local user group networking should be fostered which would include sharing of issues, protocols, questionnaires etc.

Protocols: (Each DXA unit should have written protocols).

Written protocols should be seen as part of licensing requirements. The feasibility of this needs to be explored at national level.

The written protocols should incorporate the following aspects:

Quality control data, phantom scanning & calibration

Indications for BMD

Central DXA for diagnosis

Diagnosis in postmenopausal women

Diagnosis in men (≥ 20 years)

Diagnosis in women (age 20 to menopause)

Diagnosis in children (< 20 years)

Serial BMD measurement

Precision assessment

VFA: indications

Baseline DXA reports: minimum requirements

Follow-up DXA report: minimum requirements

Contraindications for DXA scan

Procedure steps: pre, intra and post procedure

Written protocols should be regularly reviewed, audited and dated at local level.

As part of this each DXA unit should have written clear transparent criteria for prioritisation ideally based on national guidelines and at least in part based on clinical risk factors.

Overall:

At national, regional and local levels there is a need for leadership in bone health, otherwise it will continue to be neglected and to fall between disciplines and specialties, while those at risk get less than optimal care.

Introduction

The clinical significance of Osteoporosis lies in the fractures that arise and their attendant morbidity and mortality. Measurements of bone mineral density (BMD) by Dual energy X-ray Absorptiometry (DXA) are central to the diagnosis and assessment of osteoporosis and are a central component of any service provision based on the internationally agreed definition of osteoporosis.

Fractures due to osteoporosis affect at least $\frac{1}{3}$ women and $\frac{1}{5}$ men over 50 years¹. Due to demographic changes alone, the number of fractures will double over the next few decades unless effective strategies are implemented now. In addition an increasing awareness of osteoporosis combined with the development of treatments with proven efficacy will increase demand for more effective management of patients with osteoporosis. This in turn will require even more accessible facilities for diagnosis and management³.

The European Commission in 1998, in addition to recommending that osteoporosis be adopted as a major health care target by the EU and governments of member states, recommended that access to bone densitometry should be universal for people with accepted clinical indicators.¹ Kanis in 2003 compared DXA needs of various European countries to their current supply.² Figures for Ireland were not available. The aim of this survey was to provide a baseline view of current DXA services in Ireland.

Methodology

DXA locations were identified from personal knowledge of the two investigators, and by asking key health-care workers, in different areas, to name DXA locations of which they were aware. These locations were contacted and invited to complete a telephone questionnaire, during late October-early December 2006, which covered aspects of DXA scan +/- Osteoporosis service. The compiled answers were returned to each participant to check for veracity.

Results

Responses show that there is a wide range of services available. In some settings only DXA scanning is undertaken while in other settings complete Osteoporosis services are provided which include DXA scans.

Sixty-one locations (with 63 scanners) were identified. Of these two locations were not in operation as staff had not been assigned. Of the 59 staffed locations, 53 (89%) participated.

Data on scanner locations and numbers of scanners based on population of hospital network areas are shown in Table 1a. Given the variance in the number of scans undertaken by each scanner in any period of time, the numbers of scanners/100,000, while showing the variance at a population level in the provision of scanners from

1/46,047 to 1/130,694, does not reflect the approximate number of scans at a population level (Table 1b).

Additional details of locations, numbers of scanners and approximate annual number of scans for each Hospital Network and each Local Health Office geographic area are provided in appendices 1 and 2.

Table 1a: DXA Scanners vs Population Base (Hospital Network)

Hospital Network	Scanners	Locations	Population	Scanners per population
1 South East	10**	10**	460,474	1/46,047
2 South	6	6	620,525	1/103,420
3 North East	3	3	392,082	1/130,694
4 West / North West	9 (+1)	8 (+1)	651,249	1/72,361
5 Dublin South	10 *(+&)	10 *(+&)	479,855	1/47,985
6 Dublin Mid-Leinster	6* (+1)	6* (+1)	735,856	1/122,642
7 Mid-West	6**	5**	360,651	1/60,108
8 Dublin North	11	11	534,233	1/48,566
Total (+1) not in op * these are the non-responders	61 (+2) (+&) new in op ie not included as no patients yet seen	59 (+2)	4,234,925	1/69,425

Table 1b: Population Base vs Annual DXA Scans (approximate)

Network/former HB	Annual DXA Scans	Population	Scans/100,000 (approximate)	Caveats
1 South East	4,720	460,474	1,025	Excludes 1 estimate from new (mixed) service, plus 2 (private) non responders
2 South	12,940	620,525	2,085	
3 North East	4,100	392,082	1,046	
4 West / North West	9,350	651,249	1,436	
5 Dublin South	14,650	479,855	3,053	Excludes 1 (private) non responder
6 Dublin Mid-Leinster	8,360	735,856	1,136	Excludes 1 estimate from new (private) service, plus 1 (private) non responder
7 Mid-West	4,690	360,651	1,300	Excludes 2 non responders
8 Dublin North	10,920	534,233	2,044	
Total	69,730	4,234,925	1,647	Excludes: as above

Settings: Of the 59 locations, 21 (35.6%) were in Public Hospitals, while 15 (25.4%) were in Primary Care. Location in a Public Hospital did not equate with a service free to all users. Settings with DXA scanners are as follows:

Tertiary/Regional Acute Hospital	8 (1 with 2 scanners, 1 which is fracture liaison only)
Acute General Public Hospital	7 (excludes 2 not yet in operation)
Specialist Public Hospital	6 (1 with 2 scanners), (includes 1 non responder)
Primary Care	15 (includes 3 non responders)
Private Hospital	11 (1 with 3 different services)
Private Consultant Medical Centre/hospital	1
Private Consultant Clinic (Public Hospital grounds)	2 (includes 1 non response)
Private Consultant Clinic	4 (includes 1 non response)
Single Specialty Clinic	2
Private Radiology Clinic	3

Funding: The survey did not specifically enquire about the way the service was initially funded i.e. purchase of scanner, equipping of the scanning and consultation rooms, allocation and funding of staff. However, most respondents from publicly funded hospitals commented that in many instances the scanner had been purchased privately/charity and in some instances funding for staff was also provided by this means. In other instances, where staff had not been funded by such an external source, staff were rostered by the public health service, sometimes on an ad-hoc basis, to provide DXA scans. Many of the private providers had commenced the service, due in part, as a response to the long waiting lists to free public DXA scans and/or distances patients had to travel to access a free public service.

Patient Charges: Respondents were asked about costs to patients. For five of the six non-respondents information was available on this. Nine (15.5%) services were free to all users.

Free to all users	9 (15.5%)
Mixed	13 (22.4%)
Charge to all users	36 (62.1%)

Information on charges is given in greater detail by hospital network area in Table 2 below as can the ratio of free:charged services.

Table 2: DXA scan - patient charges

Network	SE	South	NE	NW / West	Dublin South	Dublin Mid Leinster	Mid west	Dublin North	Total
Free to all users	1 (10%)	1 (16.7%)	-	2 (25.0%)	3 (30.0%)	1 (16.7%)	-	1 (9.0%)	9 (15.5%)
Mix	2 (20%)	1 (16.7%)	1 (33.3%)	1 (12.5%)	1 (10.0%)	1 (16.7%)	1 (25%)	5 (45.0%)	13 (22.4%)
Free%: Charge%	75:25 80:20	20:80	78:22	10:90	45:55	50:50	(?)	15:85 25:75 40:60 50:50 75:25	
Charge to all users	7 (70%)	4 (66.6%)	2 (66.6%)	5 (62.5%)	6 (60.0%)	4 (66.6%)	3 (75%)	5 (45%)	36 (62.1%)
Total	10	6	3	8	10	6	4	11	58

Details of actual charges for the mixed and private facilities were provided to the authors. Where there was a charge to patients this ranged from €20 to €140. It is important to remember that in some cases this service included scan only, while in others it included full work-up for Osteoporosis with commencement on appropriate bone health programme and all relevant investigations.

Respondents were asked about the number of years their scan service had been in operation as this could influence matters such as waiting times and workload. These are available from individual network reports and are not included in this national report (see appendices).

Details of types of scanner and of catchments areas were also provided by respondents and are available for each individual Local Health Office population reports (see appendices). For ease of presentation in this report the populations used are those of the eight Hospital Networks but this is not to ignore the reality that most DXA scan services were not solely dealing with people from such Network demarcations.

DXA sessions (each session = 0.5 days)

Respondents were asked how many sessions per week the scanner operated. Where this was not readily available respondents were asked to make an approximation based on number of scans done in a week/month etc. This is provided in detail as to summarise would lose important information. It should be read in the context of waiting time information, approximate annual number of scans, and the data on funding and charges. During each session depending on the type of service, the service ranged from scanning the patient with informal assessment of risk factors to full patient work up and commencement on treatment if required. Only five of the 21 scanners in public hospitals (20) provided 10 scan sessions each week.

Table 3: Scan Sessions by location

Hospital Network	Setting	Sessions /week
South-East	Tertiary/Regional Acute Hospital	1(fracture liaison)
	Acute General Public Hospital	Ad hoc as resources allow (staff)
	Acute General Public Hospital	5
	Primary Care GP	As needed
	Primary Care GP	4
	Private Hospital	10 (available)
	Private Hospital	3
	Private Consultants Clinic	8 (available)
South	Tertiary/Regional Acute Hospital:	10
	Acute General Public Hospital	3
	Primary Care	2 (has spare capacity)
	Private Hospital	8
	Private Hospital	10
	Private Radiology Clinic	10 (available)
North-East	Acute General Public Hospital	2
	Primary Care	11 (includes evenings, Sat am)
	Primary Care	5 (more available, plus evenings)

Hospital Network	Setting	Sessions /week
West / North West	Specialist Public Hospital	10 scan 1, 4 scan 2
	Specialist Public Hospital	2-10 ~rosters/other duties
	Primary Care	4-5
	Primary Care	4-5
	Primary Care	10 opportunistically
	Private Hospital	5 (has spare capacity)
	Single Specialty Clinic	2
	Private Consultants Clinic	10 (has spare capacity)
Dublin South	Tertiary/Regional Acute Hospital	10
	Tertiary/Regional Acute Hospital	10
	Acute Public Hospital	3
	Acute Public Hospital	4
	Primary Care	4 (has spare capacity)
	Private Hospital	9
	Private Hospital	5 (has spare capacity)
	Private Consultants Clinic	5
Dublin Mid-Leinster	Private Radiology Clinic	10 (available plus late even, Sat am)
	Tertiary Acute Hospital	2
	Acute Public Hospital	10
	Primary Care	10 available
	Private Hospital	10 available
Mid-west	Private Hospital	4
	Regional Acute Hospital	5 scan 1 5 scan 2
	Single Specialty Clinic	10 available
Dublin North	Private Cons Medical Centre/hospital	3
	Tertiary/Regional Acute Hospital	4
	Tertiary/Regional Acute Hospital	8
	Sp Public Hospital	8
	Sp Public Hospital	5
	Sp Public Hospital	6
	Primary Care	10 available
	Primary Care	4 (more available)
	Private Hospital	5-10 (~workload)
	Private Hospital	10
	Private Cons Clinic (Public Hospital grounds)	8
Private Radiology Clinic	10 available (has spare capacity)	

Table 4 shows the variability in the number of scanning sessions in the public and private setting based on hospital network areas. As for table 3, it should be remembered that depending on the type of service, a session ranged from scan only to full patient work up and commencement on any required treatment.

Table 4: DXA Sessions weekly: Public setting & Private setting by Network location (n=53)

Network	Public Setting	Private setting
South East	6 + as staff resources allow in one setting	25 available +as needed in one setting, (& 2 non respondents)
South	13	30
North East	2	16+
West / North West	14 +2-10 (as staff resources allow)	36
Dublin South	27	33 (&1 non respondent)
Dublin Mid-Leinster	17	24 (&1 non respondent)
Mid West	10 (&1 non respondent)	17 (&1 non respondent)
Dublin North	31	52

Waiting times: Details were sought on waiting times of two weeks or more, Table 5. Over one third of settings had scan request waiting times of over two weeks. All but one of these, were in public settings. The waiting time delay ranged from 4 weeks to 52 weeks with a median of 16 weeks.

Table 5 Waiting Times for Scans (n=53)

Network Area	Available On request	Waiting Time >2 weeks	Setting of those with waiting time >2 weeks
South East	5 (62.5%)	3 (37.5%)	26 weeks: acute public hospital 4 weeks: acute public hospital Regional Acute Hospital fracture liaison: only book if can scan within 1 week
South	3 (50.0%)	3 (50.0%)	4 weeks: acute public hospital 40 weeks: acute public hospital, 4 weeks: Private Hospital
North East	2 (66.6%)	1 (33.3%)	Acute Public Hospital: 26 wks if public, 4 wks if private
West / North West	6 (75.0%)	2 (25.0%)	Specialist Public Hosp: 28 wks Specialist Public Hosp (2): 4 wks if Consultant refers, 12 wks for Clinical Risk Factors from GP, 36 wks others
Dublin South	5 (55.5%)	4 (44.4%)	26 weeks: Tertiary/Reg acute hospital 16 weeks: Tertiary/Reg acute hospital 21 weeks: acute public hospital 12 weeks: acute public hospital
Dublin Mid	3 (60.0%)	2 (40.0%)	8 wks: acute public hospital

Network Area	Available On request	Waiting Time >2 weeks	Setting of those with waiting time >2 weeks
Leinster			26 wks: tertiary/Reg acute hospital: will prioritise children & adults with Chronic renal failure
Midwest	2 (66.6%)	1 (33.3%)	Regional acute hospital: 24 weeks if non urgent
Dublin North	8 (72.7%)	3 (27.3%)	Tertiary/Reg Acute Hospital: 9 wks Tertiary/Reg Acute Hospital: 10 wks if non urgent Specialist Public Hospital: 52 wks if public unless referrer phones re urgency, 5 wks if private
Total	34 (64.2%)	19 (35.8%)	

Where the waiting time exceeded two weeks, respondents provided information on whether and how requests for DXAs were prioritised. All Tertiary/Regional Acute Hospitals (8) had waiting times longer than two weeks. All had system for prioritising requests.

All seven of the acute public hospitals had waiting times longer than two weeks. Of these, two had a system for prioritising referrals, three did not have a system, while the remaining two were evolving prioritisation criteria.

Of the five specialist acute public hospitals (6 scanners) three had waiting times longer than two weeks. All had a system for prioritising referrals.

Staffing Levels: Respondents provided details of staff resources. These are available in the individual LHO reports (see appendices).

Respondents were asked whether in their opinion the waiting area for patients, scan area, discussion area for patients and staff area were adequate or inadequate i.e. 4 areas for each scan location. Almost one quarter (13, 24.5%) of the locations was inadequate in one or more respects. The area most likely to be considered adequate was the actual scan area (see appendix 3). The majority of those with inadequate facilities of any sort were in publicly funded hospitals (further information available from individual LHO reports).

Sources of referral to the scan service were multiple, as shown in table 6. All but one accepted referrals from GPs. Referrals from OPD were received by 38(71.8%) while 18 (34%) accepted self-referrals but for half of these certain criteria had to be met.

Table 6: Sources of Referral to DXA service

Referral Sources	Total	Caveats
GP	52 (98.1%)	
OPD	38 (71.8%)	Incl 1 via # liaison only
ED	6 (11.3%)	Incl 1 via # liaison only
In patient & scanned while in	30 (56.6%)	
In patient but scanned after discharge	36 (67.9%)	
Self	18 (34.0%)	6 if doctors' name supplied 1 if meet specific criteria 1 accepted but not encouraged 1 not yet finalised
Referral from other hospitals	6 (11.3%)	
Part of Health Screening package	5 (9.4%)	

To adequately scan those **aged under 20 years**, the DXA scanner should have specific software. Respondents were asked about scanning those aged under 20 years of age. As a number of locations were based in hospitals for adults, most were quite clear in their answer with regards to children, however, for those patients aged 16-20 years the answer was less clear. Details of this are shown in table 7 below together with all the caveats.

Table 7: Age of Patients accepted for DXA scans

Hospital Network		All ages	>20 yrs	> 50 yrs	Comment	Total
1	South East	2	4	2^^	<i>^ pre-menopausal scanned only if specific criteria met ^ # liaison only</i>	8
2	South	-	6^		<i>^ one will rarely scan <20yrs</i>	6
3	North East	-	3^		<i>^ one will scan 16-20yrs if specifically request</i>	3
4	West/North West	3^	5		<i>^for one <16yrs must be specifically requested by Consultant</i>	8
5	Dublin South	2	7^		<i>^for one <20yrs must be specifically discussed by Consultant with Radiologist</i>	9
6	Dublin Mid Leinster	3	2^		<i>^ one will scan 16-20yrs if referrer aware that software is for >20 yrs</i>	5
7	Mid-west	2	1			3
8	Dublin north	2	9^^^		<i>^^ two will scan 16-20yrs if specific request ^ one scans children with metabolic diseases</i>	11
Total		14	37	2	<i>Caveat: question not always clear re 16-20yrs, as many hospitals only accepted adults but the age varied from 16-20yrs ^ see above</i>	53

Where a scan was requested for a woman of child bearing age, all locations used the last menstrual period rule. In the case of use of Depo-Provera, one location requested a pregnancy test and for the patient to sign a DXA consent form.

As mentioned earlier the **components included in the DXA service** reflected a range of provision from solely providing a DXA scan to a complete Osteoporosis service which included a DXA scan. These components are shown in table 8 below by

hospital network. Within the one scan setting, in some instances different services were offered as is evident below.

Table 8: Components of DXA Service

Network	DXA Scan	Formal lifestyle questionnaire	Discussion of clinical risk factors	Provide Educational Materials	Others: specify
South East	8	4	5 formal 1 informal	8	1. falls risk assessment. 2. Dietician referral if indicated
South	6	4	4 formal 2 informal	6	-
North East	3	3	2 +1*	3	1. Nurse referral to Allied health Professionals
West / North West	8	6	7	8	-
Dublin South	9	6 +1**	6 +1**	8	1. One service scan report, other service: full consultation 2. Monthly Lecture 3. Consultation with full work-up includes relevant blood tests, Rx 4. Relevant blood test, diet advice, heel US
Dublin Mid Leinster	5	3+1***	3+1***	5	1. If hospital referral patient sees Gynae/Rheum on day of scan
Mid West	3	2	2	3	-
Dublin North	11	8	6 +1 ad hoc +1 ****	10	1. Relevant blood test, diet advice, heel ultrasound 2. Discuss scan with patient, plus random BP, cholesterol, falls assessment

+1*: non GMS have full nurse consultation, GMS informal discussion

+1**: if for Consultant service (ie offers various types of service)

+1***: if hospital referral patient sees Gynaecologist/Rheumatologist on day of scan

+1**** for attention of Rheumatologist

Scan Sites: In most (51, 96%) services, the spine was routinely scanned. In half the services, both hips were scanned. If for particular patients, the hip or spine could not be scanned, 7 (13.2%) were not able to scan the forearm or equivalent. Of the services providing other than fracture liaison (52), 25 (48%) used lateral vertebral assessment. Routine peripheral DXA was not provided by most (42, 79.2%) services.

For the majority of DXA service providers (48, 90%) patients accessed their **results** via the referrer. For just over half (28, 52%) reports were also sent to the patients GPs/other named doctors. Of the latter in two cases, this had to be specifically requested while in one it only applied to those who had availed of a specified Consultant service at the scan location. In another case the report to the GP also included the patient's falls risk assessment.

In 16 (30.2%) instances, the patient was given the result verbally on the day. However, of these ten had caveats. For 5 (9.4%) services the patient was given a copy of the scan print out to bring to their referrer. Of these five, 3 had caveats (appendix 4).

Respondents were asked whether the **reports** to the referrer included bone densities only, bone density results with a written interpretation of these, the latter plus an interpretation in the context of the patients risk factors or all of the preceding plus suggested therapies. Only two services provided just the first option i.e. bone densities only but even for one of these the latter applied just to patients from outside their practice list. The detail is shown in table 9 below. For some locations there was more than one answer depending on the actual scan service the patient received. How this looked on a Network basis is shown in appendix 5.

Table 9: DXA Report Details

Bone Mineral Density only (A)	(A) plus written interpretation (B)	(B) & interpret wart Risk Factors (C)	(C) & suggest Rx
1	14	5	27
+1 for non practice patients only	+1 GMS: scan print out & pre-printed generic Rx suggestions	+1 depends on radiologist	+1 occasionally
	+1 suggested Rx	1 if hospital/OPD referral	+1 where its for non GMS only
	+1 if health screen service		+1 if Consultant service
	+1 if GP referral		+1 if hospital/ OPD referral
			+1 plus 10 yr #risk assessment
			+1 for own practice

For those patients needing **follow-up**, a variety of recall methods were used. These were in descending order of frequency:

Rely on Referrer and on patient	20 (37.7%)
Rely on Referrer	16 (30.2%)
Recall system in place	7 (13.2%)
Rely on Patient	2 (3.8%)
Rely on Referrer and on recall system	2 (3.8%)
Rely on Patient and on recall system	1 (1.9%)
Rely on Patient, on Referrer and on recall system	1 (1.9%)
Recall system if own patients, rely on patient if outside practice	1 (1.9%)
Method not yet finalised	3 (5.6%)

Written **protocols** were in place in thirty two locations (60%). Details of aspects included in these written protocols are available from individual LHO reports (see appendices).

Of the remaining 21 settings, sixteen had verbal procedures covering most of the aspects covered by written procedures in other locations, one had them for self referrals, three were in the process of developing their own written protocols while the remaining one was interested in obtaining protocols from other locations so as to adapt for local use.

All but one of the units was registered with the Radiological Protection Institute of Ireland (this location was in process of same). Local radiation rules were displayed on the walls of all but three department/units. All had **quality control** (QC) programmes in place. Copies/back-ups of QC printouts were kept by all. The QC plot was regularly studied by all. If the QC failed, all would rescan and/or contact the engineer before continuing to scan.

The questions on **training** and **Continued Professional Development** generated many comments from respondents. Given the number and variety of staff involved in the service, their level of training and training needs cannot be fully summarised here (further details are available in the individual LHO reports). At the time of the survey,

- one or more members of staff from all settings had attended Manufactures' training
- one or more members of staff from 51 (of 53) settings had attended Radiation Protection training
- one or more members of staff from 26 (49%) settings had attended National Osteoporosis Society (NOS) training
- one or more members of staff from 15 (28%) settings had NOS certification
- one or more members of staff from 6 (11.3%) settings had Vertebral Fracture Assessment (VFA) training
- one or more members of staff from 3 (5.7%) settings had International Society for Clinical Densitometry (ISCD) training.

A large number of **comments** and suggestions (over 250) were provided by participants. Many overlapped and were repeated time and time again. An attempt to summarise them follows. However, further details are in appendix 6.

An **overall** comment was the neglect of the whole area of bone health and the lack of appreciation both by Health Services generally and many health care workers of the importance of bone density in terms of quality of life, morbidity and death.

Primary Community and Continuing Care: Patients in high risk groups all attend hospital services yet in a number of instances they only had a DXA scan where a scanner was acquired by Primary Care, at which stage these known high risk patients were scanned, investigated and commenced on appropriate prevention and treatment before they presented with major complications. The lack of and uncertainty regarding continuation of programmes e.g. exercise programmes in communities/ day centres was frustrating for staff and patients.

Awareness: The general public, high risk groups and relevant patient support bodies need better awareness of the total area of bone health. A reliable ongoing source of relevant literature should be available in appropriate locations. Both patients and health care workers (Haws) need to better understand the process of bone health from prevention to treatment. Two groups, Orthopaedic surgeons and male GPs, were

particularly mentioned in this regard by many respondents. The potential benefit of each hospital having a Consultant to lead across the disciplines on bone health was raised as an issue worth exploring.

Funding: The DXA service should be a fully funded core service delivered in a planned dedicated manner.

DXA service provision should be available based on equity including geographic, timeliness and cost. Many patients are in risk groups or of an age where long journeys can cause hardship – local private providers should be re-embossed to provide services to those in high risk groups as a short-term measure in the absence of a free local service.

As a minimum DXA scans, which is an important preventive service should be free to those in risk groups – all are entitled to free hospital services. If this needs to be introduced on a phased basis, initially all those with medical cards in high risk groups should in the 1st instance be offered an accessible service. DXA scans for high risk patients should be covered by all health insurers.

Currently where the service is not free, in many instances not only is the patient paying for scan but has 1st to attend referrer for referral (and pay) and then return (and pay) for results. In some instances where patient does not have medical card, he/she having paid for investigation cannot afford treatment cost despite drug refund scheme.

Staff: Comprehensive bone health programme requires multi-disciplinary skills and teams, the number of which should be based on need. This includes the need for allocation of sufficient staff in publicly funded hospitals, where there is a waiting time of more than a few weeks, to provide 10 DXA sessions per week. Included here is the need for every fracture clinic to have either fracture liaison nurse or Osteoporosis nurse attached and also for staff who carry out DXA scans to do so in blocks/sessions rather than fitted in around other service demands.

Facilities: Ideally DXA scanners should not share rooms with other radiological equipments thereby decreasing the ability to use them to full capacity. The provision of up to date DXA service has potential to have positive workload effect e.g. reduce demand for lumbar spine X-rays, reduced admissions of people with fractures etc.

Planning, Quality, Audit, Standards: In the opinion of a number of respondents, cases of poor practice are occurring which have major adverse effects on the patients. Universal good quality practices should not to wait for proof of negligence or malpractice. Regulations regarding the running of DXA scan units are needed at national level. To help ensure quality and standards only qualified staff trained on DXA use should deliver the service.

Currently due to over-stretched staff resources, audit and evaluation of DXA services both the technical and wider aspects including what happens for the patient after their scan, on the return to their referrer etc are rarely addressed.

Training & Updates/CPD: For a quality safe service, all involved in the service, regardless of location, need to be provided with appropriate regular ring fenced

training and updates. A central repository of training information, standards and guidelines for various relevant health care workers could be developed.

Communication / Networking: Regional/local user group networking should be fostered which would include sharing of protocols, questionnaires etc. These would also include developing and sharing written protocols for accepting referrals from specified Health Professionals other than medical doctors.

As part of this a communication network would help keep relevant health professionals up to date especially those in more isolated areas. Such discussion this could also help tease out issues such as self referrals e.g. what is the onus on a doctor where a patient arrives with a DXA scan report which doctor did not request, what about the high risk patient who requests his/her doctor to refer for DXA and doctor refuses – currently in some such instances, patient relies on being able to self-refer, what is the role of Pharmaceutical companies – in a number of instances they provide/subsidise training updates, fracture liaison services etc. In their absence would there be any service or would public funding be provided?

Discussion

The results of this survey show that at the end of 2006, at the time of the survey, in Ireland access to DXA services was not available in an equitable manner in terms of geography, cost or need. This is clear from the variation in spread, variation in charges, variation in actual service and duration of waiting times. This is not in keeping with the spirit of the 1998 recommendation of the European Commission¹ which recommend that access to bone densitometry systems should be universal for people with accepted clinical indicators and reimbursement should be available for such individuals.

Unfortunately as osteoporosis crosses many disciplines, neither its treatment nor prevention is championed by any one group. Instead it falls between the disciplines. This compares with other health issues where there is often one lead speciality. The difference can best be illustrated by comparing BMD and DXA with the case for measuring blood pressure or cholesterol levels. The ability of BMD to predict fractures is comparable to the ability of blood pressure to predict stroke and better than that of serum cholesterol to predict myocardial infarction. Yet as these latter are championed by the cardiology community the public, health care professionals and managers are much more likely to ensure that the latter are relatively widely available as compared with BMD testing³.

In the view of many experts including Fogelman⁴ with new developments in DXA scanning, accurate assessments of the clinically important sites in the skeleton such as hip, spine and forearm with low levels of radiation to the patient are now routinely possible and despite the potential pitfalls in interpretation such as incorrect positioning of the patient, previous fracture and degenerative changes, excess changes in body weight etc “DXA scan should be regarded like a chest X ray; everyone at risk should be entitled to have a DXA”.

As well as access to a DXA scan, people should have access to a quality DXA service. Systems should be in place to ensure that people receive a quality service – written audited protocols based on international best practice covering all the technical aspects of DXA scans – by staff trained and regularly updated on courses which are based on internationally recognised courses and qualifications, and have access to a total bone health/osteoporosis management services.

In their study of European needs, Kanis et al² were unable to include Ireland due to lack of national information on fractures and on DXA provisions. To analyse fracture trends, to monitor what happens both in terms of fracture outcomes and investigation for fragility fracture, national fracture registries are needed. However the needs for DXA can be based on population demography. Based on their original study² Ireland needed 10.6 DXA scanners /million population based on the assumption that each scanner functioned to maximum capacity. Clearly this is not the case in Ireland where only five of the DXA scanners in the twenty one public locations functioned for ten sessions per week. In addition as was evident from the survey there was quite a variation in throughput for each unit and there was a wide range of services included e.g. DXA only to total bone health management. The needs estimated by Kanis et al will increase with increased recognition of risk factors plus improved referrals from high risk specialities such as orthopaedics.

Based on figures from International Osteoporosis Foundation which in turn were based on figures from 23 centres on average, 3000 patients were scanned annually per centre with a staffing of 2.39WTEs. This was 1256 patients for each DXA unit per year i.e. per staff member². Few of the DXA scanners in this survey had a throughput over 1,000 annually despite lengthy waiting times. This was usually due to sharing of space with other modalities such as mammography or more commonly competing priorities on staff time and DXA scans were deemed low priority.

Just over one third (21, 35.6%) of DXA scanners in Ireland are based in Public Hospitals. (This did not always mean that they were free to the user). This compares with England where 77% were based in the NHS⁵.

In terms of hospital cost, in women the burden of osteoporosis fractures exceeds that attributable to breast cancer, Myocardial Infarction or stroke⁶. In Europe, the number of disability life years (Daly's) resulting from osteoporosis fractures exceeds that associated with many other chronic diseases including asthma, hypertensive heart disease, Rheumatoid Arthritis and with many forms of malignant disease including breast cancer, colon cancer, stomach cancer and cancer of the prostate⁷. Each fracture can result in as many 9 excess GP visits in the year following injury⁸. Patients with hip fractures occupy 1/5 orthopaedic beds. Failure to acknowledge this impact on people and on health services, will result in even larger figures in the future.

Internationally despite the availability of effective treatment many people with established osteoporosis and many others at high risk are not treated². This is likely to be the situation in Ireland given that for most DXA is pivotal to diagnosis.

It is estimated that 95% of people who have an Osteoporosis fracture are never evaluated or treated for this disease⁹. The situation in Ireland is unknown but it is

unlikely to be much different given the recurrent concerns of participants about relative lack of referrals from Orthopaedics.

In 2004 the US Surgeon General's report on Bone Health and Osteoporosis¹⁰ called on health care workers to proactively assess, diagnose and treat patients at risk for osteoporosis. In the same report DXA was hailed as one of most significant advances of last quarter century¹⁰. Given the relative lack of referrals to DXA from high risk specialties such a pro-active approach is also needed in Ireland.

The three preceding paragraphs highlight the issue of lack of awareness of risk factors among health care workers. There is the need to pro-actively address this especially in high risk areas such as orthopaedics. Fracture liaison nurses or osteoporosis nurse should be attached to all fracture clinics. Patients should not have to suffer repeat fractures with its consequence because health care workers failed investigate appropriately.

Part of the problem is due to lack of general awareness that a prior fracture is a high risk for further fractures and part lies in the heterogeneity of access to BMD measurements².

Elliot-Gibson et al¹¹ in their systemic review of practice patterns in the diagnosis and treatment of osteoporosis after a fragility fracture: 14 of 16 studies reported investigation <32% of patients for BMD. Where it was investigated there was a high rate of osteoporosis diagnosis (35-100%).

Clinical trials have shown that treatment of patients with fragility fractures can reduce the risk of future fractures by up to 50%^{12,13}. One of the most compelling reasons to determine the aetiology of a fractures and provide appropriate treatment is that a previous low energy fracture is among the strongest risk factors for new fractures^{14,15,16}. Specifically patients with low energy fracture of wrist, hip, proximal humours or ankle have nearly a 2-4 fold greater risk for future fractures than those with who have never experienced a fracture^{15,16}. Taken together, patients with a history of any fracture have a 2-6 fold increased risk of subsequent fracture compared to those without a previous fracture so optimal care of fragility fractures includes not only management of the presenting fracture but also evaluation, diagnosis and treatment of the underlying cause, including low BMD.

Based on the above, many fractures can be anticipated and prevented if health care workers take a pro-active approach. In a survey of older people, 80% said they would rather die than experience the reduced quality of life (QOL) that follows a hip fractures¹⁷. 40% of patients who sustain a clinical vertebral fracture will have constant pain and the majority will have difficulties with activities of daily living (ADSL)¹⁸. Given knowledge of risk factors the number of people suffering such QOL and ADL issues could be substantially reduced.

The DXA service must be a quality service and should be part of a multi-disciplinary bone health/osteoporosis service. All those reading reports should either understand or have access to expertise in the area of osteoporosis. Also those under the aged of 20 years should be scanned using appropriate software and experienced staff in an accessible location. An additional issue was the question of repeat DXAs and when

these were done on different scanners. According to ISCD it is not possible to quantitatively compare BMD or to calculate a least significant change between facilities without cross-calibration¹⁹.

It was not possible in this survey to review all the technical aspects of current DXA services in Ireland. However, it was evident that there is variation in practice and for some uncertainty in some of the aspects. Based on the comments received many would welcome national standards and guidelines. International guidelines based on evidence and best practice are available¹⁹.

As for the technical aspects but even more forcibly were respondents concerns about availability of training, quality of training, and access to training at national and regional levels. In the same vein were issues around continuous professional development. For many it was ad hoc, patchy and difficult to access. Recognised evaluated courses and qualifications are available internationally. A quality service relies on quality training which in turn needs national standards and recognition.

Conclusion

Provision of DXA in Ireland is sub-optimal as it is in some areas of Europe². Failure to ensure accessible DXA scans as part of core health services is having and will increasingly have serious impact on people's mortality and morbidity and also on health service resources. The efficient use of BMD for assessment could save up to a quarter of all fractures². Current DXA service provision and practice is a potential high risk liability area.

References

1. Policy Report 1998: Report on Osteoporosis in European Community Action for Prevention
2. Kanis JA, Johnell O: Requirements for the Management of Osteoporosis in Europe Osteoporosis International (2005) 16:229-238
3. Kanis JA Osteoporosis: taking account of risk factors and quality of life. *Medicographia*. 2006; 28:3-8
4. Fogelman I, Masterclass Osteoporosis. Royal College of Physicians (Ireland) 2006
5. National Osteoporosis Society. Bone densitometry provision in England – report 2005
6. EU Osteoporosis Consultation Panel and European Parliament Osteoporosis Interest Group. Osteoporosis in the EU: improving the assessment of fracture risk. 2006
7. Johnell O, Kanis JA: An estimate of the worldwide prevalence & disability associated with Osteoporotic fractures. *Osteoporosis International* 2006
8. Dolan P, Torgerson DJ. The cost of treating Osteoporotic fractures in the United Kingdom female population. *Osteoporosis International* 1998;8: 611-617
9. NIH Consensus Statement Online 2000: Osteoporosis prevention, diagnosis and therapy 17(1): 1-36)
10. US Surgeon General. Bone Health and Osteoporosis. A report of the Surgeon General. Department of Health and Human Services 2004
11. Elliot-Gibson V, Bogoch ER, Jamal SA, Beaton DE. Practice patterns in the diagnosis and treatment of osteoporosis after a fragility fracture: a systematic review. *Osteoporosis International* (2006) 15 (10):767-778
12. Delmas PD: Treatment of postmenopausal osteoporosis. *Lancet* 359 (9322): 2018-26. 2002
13. Hochberg M. Preventing fractures in postmenopausal women with osteoporosis. A review of recent controlled trials of antiresorptive agents. *Drugs Aging* 17(4): 317-330. 2000.
14. Cummings SR, Melton LJ. Epidemiology and outcomes of Osteoporotic fractures. *Lancet* 359 (9319): 1761-7. 2002
15. Nevitt MC, Ross PD, Palermo L, Musliner T, Genant HK, Thompson DE. Association of prevalent vertebral fractures, bone density and alendronate treatment with incident vertebral fractures: effect of number and spinal location of fractures. The Fracture Intervention Trial Research Group. *Bone* 25(5): 613-9. 1999
16. van Staa TP, Leufkens HG, Cooper C. Does a fracture at one site predict later fractures at other sites? A British cohort study. *Osteoporosis International* 13(8): 624-9. 2002
17. Salkeld G, Cameron ID, Cummings RG et al. Quality of life related to fear of falling and hip fracture in older women: a time trade off study. *BMJ*: 320: 341-346. 2000
18. Scane AC, Sutcliffe AM, Francis RM. The sequelae of vertebral crush fractures in men. *Osteoporosis International* 4: 89-92. 1994
19. International Society for Clinical Densitometry

Appendix 1 DXA Facilities by Hospital Network (for LHOs see appendix 2)

Network 1 HSE South-East	Population	460,474
	Number of DXA Scanning locations	10**
	Number of DXA Scanners	10**
	Annual scans	~4720
**includes 2 non responders ~missing 1 estimate as service just starting, & missing 2 non responders		
Network 2 HSE South	Population	620,525
	Number of DXA Scanning locations	6
	Number of DXA Scanners	6
	Annual scans	12,940
Network 3 HSE North East	Population	392,082
	Number of DXA Scanning locations	3
	Number of DXA Scanners	3
	Annual scans	4,100
Network 4 HSE West / North west	Population	651,249
	No of DXA locations 8 (+1 not in operation)	
	No of DXA Scanners 9 (+1 not in operation)	
	Annual scans	9,350
Network 5 HSE Dublin South	Population	479,855
	Number of DXA Scanning locations	10*
	Number of DXA Scanners	10*
	Annual scans	14,650*
* one non-response so missing information		
Network 6 HSE Dublin Mid-Leinster	Population	735,856
	No of DXA locations 6* (1 not in operation)	
	No of DXA Scanners 6*(+1 not in operation)	
	Annual scans	8360*^
* missing information from one setting ^ 1 setting just starting		
Network 7 HSE Mid-West	Population	360,651
	Number of DXA Scanning locations	5**
	Number of DXA Scanners	6**
	Annual scans	4690**
**no information from two locations		
Network 8 Dublin North	Population	534,233
	Number of DXA Scanning locations	11
	Number of DXA Scanners	11
	Annual scans	10,920

Appendix 2: DXA Facilities by Local Health Office Geographical Area

Network 1 HSE South-East	Waterford	Local Health Offices: Population = 119,914 Number of DXA Scanning locations 4** Number of DXA Scanners 4 ** Annual scans ~ 1360 **includes 2 non responders ~ missing 2 non responders
	South Tipperary	Population = 88,274 Number of DXA Scanning locations 3 Number of DXA Scanners 3 Annual scans 1080
	Wexford	Population = 131,615 Number of DXA Scanning locations 1 Number of DXA Scanners 1 Annual scans 840
	Carlow/Kilkenny	Population = 120,671 Number of DXA Scanning locations 2 Number of DXA Scanners 2 Annual scans ~1440 ~missing 1 estimate as service just starting
Network 2 HSE South	Kerry	Local Health Offices: Population = 139,616 Number of DXA Scanning locations 1 Number of DXA Scanners 1 Annual scans 1680
	North Cork	Population = 80,795 Number of DXA Scanning locations 1 Number of DXA Scanners 1 Annual scans 250
	West Cork	Population = 53,445 Number of DXA Scanning locations 0 Number of DXA Scanners 0 Annual scans 0
	Cork North Lee	Population = 167,536 Number of DXA Scanning locations 0 Number of DXA Scanners 0 Annual scans 0
	Cork South Lee	Population = 179,133 Number of DXA Scanning locations 4 Number of DXA Scanners 4 Annual scans 11,010
	Network 3 HSE North-East	Louth

	Number of DXA Scanners	1
	Annual scans	2400
Cavan/Monaghan	Population = 118,567	
	Number of DXA Scanning locations	2
	Number of DXA Scanners	2
	Annual scans	1700
Meath	Population = 162,621	
	Number of DXA Scanning locations	0
	Number of DXA Scanners	0
	Annual scans	0
Network 4 HSE West / North-West	Local Health Offices:	
Donegal	Population = 146,956	
	Number of DXA Scanning locations	1
	Number of DXA Scanners	1
	Annual scans	1680
Sligo/Leitrim	Population = 90,910	
	No of DXA Scanning locations	1(+1 not in operation)
	Number of DXA Scanners	1(+1 not in operation)
	Annual scans	1350
Mayo	Population = 123,648	
	Number of DXA Scanning locations	1
	Number of DXA Scanners	1
	Annual scans	960
Roscommon	Population = 58,700	
	Number of DXA Scanning locations	0
	Number of DXA Scanners	0
	Annual scans	0
Galway	Population = 231,035	
	Number of DXA Scanning locations	5
	Number of DXA Scanners	6
	Annual scans	5360
Network 5 HSE Dublin South	Local Health Offices:	
Wicklow	Population = 109,328	
	Number of DXA Scanning locations	0
	Number of DXA Scanners	0
	Annual scans	0
Dublin South City	Population = 134,200	
	Number of DXA Scanning locations	4
	Number of DXA Scanners	4
	Annual scans	3010*
	*one non response so missing information	
Dublin South East	Population = 110,186	
	Number of DXA Scanning locations	3
	Number of DXA Scanners	3
	Annual scans	6380

(an additional free scanner came into operation Dec 06, another for GP access is planned)

South Dublin	Population = 126,141	
	Number of DXA Scanning locations	3
	Number of DXA Scanners	3 (4 services)
	Annual scans	5260

Network 6 HSE Dublin Mid Leinster Local Health Offices:

Laois/Offaly	Population = 137,616	
	Number of DXA Scanning locations	1
	Number of DXA Scanners	1
	Annual scans	just starting up
Longford/Westmeath	Population = 113,764	
	Number of DXA Scanning locations	3
	Number of DXA Scanners	3
	Annual scans	*6960

* missing information from one setting

Kildare/West Wicklow	Population = 203,077	
	No of DXA locations	1(+1 not in operation)
	No of DXA Scanners	1(+1 not in operation)
	Annual scans	1000

Dublin West	Population = 133,562	
	Number of DXA Scanning locations	0
	Number of DXA Scanners	0
	Annual scans	0

Dublin South West	Population = 147,837	
	Number of DXA Scanning locations	1
	Number of DXA Scanners	1
	Annual scans	400

Network 7 HSE Mid-West

Local Health Offices:

North Tipperary/East Limerick	Population = 98,665	
	Number of DXA Scanning locations	1
	Number of DXA Scanners	1
	Annual scans	*
	* no information obtained	
Clare	Population = 110,800	
	Number of DXA Scanning locations	0
	Number of DXA Scanners	0
	Annual scans	0
Limerick	Population = 151,186	
	Number of DXA Scanning locations	4*
	Number of DXA Scanners	5 /?6*
	Annual scans	4690*

* no information obtained from one location

Network 8 HSE Dublin North

Local Health Offices:

North Dublin	Population = 221,771	
	Number of DXA Scanning locations	1
	Number of DXA Scanners	1

	Annual scans	360
North Central Dublin	Population = 126,679	
	Number of DXA Scanning locations	4
	Number of DXA Scanners	4
	Annual scans	3760
Dublin North West	Population = 185,783	
	Number of DXA Scanning locations	6
	Number of DXA Scanners	6
	Annual scans	6800

Appendix 3

Facilities: Inadequate (respondents' opinion) (n=53)

Network	Waiting area	Scan area	Discussion area	Staff area	No of locations
1 South East	1	1	1	1	1 (of 8)
2 South	0	0	0	1	1 (of 6)
3 North East	0	0	0	0	0 (of 3)
4 West / North west	1	1	1	1	1 (of 8)
5 South Dublin	2	0	2	1	3 (of 9)
6 Mid -Leinster	0	1	1	2	2 (of 5)
7 Mid-West	0	0	0	0	0 (of 3)
8 Dublin North	3	1	2	1	4 (of 11)
Total	8	4	8	7	13 (of 53)

Appendix 4: Additional details regarding access to reports

Patient verbally given results on day of scan (16)
1 if requested
1 occasionally
2 informally
1 written report if for Consultant Service
1 yes if seen by Nurse on day
1 occasionally if second scan
1 if see Consultant/Radiologist on day
1 if hospital referral, see Gynaecologist/Rheumatologist on day
1 if own practice patient

Patient given copy of print out to bring to referrer (5)
1: Posted copy including falls risk assessment
1: report sent to patient
1: written report if for Consultant service

Appendix 5

DXA Report includes: (multiple answers)

Network	BMD only (A)	(A) plus written interpretation (B)	(B) & interpretation wrt Risk Factors (C)	(C) & suggested treatment
South East		3	1	4 +1 occasionally
South		1	1	4
North East		1 GMS: scanner print out & pre-printed generic Rx suggestions		2 (+1 where its for non GMS only)
West / North West		2		6
Dublin South		2 +1 suggested Rx +1 if health screen service	2 +1 depends on radiologist	3 +1 if Consultant service
Dublin Mid Leinster		1 +1 if GP ref	1 if hospital/OPD referral	2 +1 if hosp/OPD ref +1 plus 10 yr #risk assessment
Mid west	1	1		1
North Dublin	1 for non practice patients	4	1	5 +1 for own practice

Appendix 6 Additional Comments from Survey Respondents

General Comments:

- Greater awareness of bone health and the risks of osteoporosis are needed by health professionals and the general population. In particular high risk populations need to be identified and managed. They need to know why treatment is necessary.
- Fall prevention needs to be part of the osteoporosis service.
- Scanning opportunities in Primary Care have enabled timely diagnosis to be made and treatment to be implemented before complications arise.
- High risk people need to be aware of what a DXA test entails e.g. simple, pain free etc.
- A regular ongoing supply of literature on osteoporosis should be provided in acute hospitals and Primary Care.

Health Professionals:

- The seriousness of osteoporosis, its diagnosis, preventability and treatability need to be part of health professional training.
- All front line health professionals who deal with high risk patients must always be well versed in osteoporosis. This is also particularly important for GPs, orthopaedic surgeons and radiologists.
- All acute hospitals should have a fall prevention and osteoporosis service which is consultant delivered and provided by a multi-disciplinary team so as to provide a comprehensive bone health programme.
- In the absence of dedicated DXA scan staff, maximum use is not currently being made of existing scanners. Demands and waiting times will increase unless dedicated staff are allocated to provide the service in public health settings.
- Every hospital fracture clinic should have either a fracture liaison nurse or osteoporosis nurse attached.

Funding:

- The service should be provided free of charge as part of the Public Health system for high-risk patients. The service should be provided on a 'needs' basis. This includes the location and resourcing of the service. In many instances, the scanner was initially bought by Charity/private funding but revenue funding is not easily organised by the health service.

Access and Equity:

- Access to the service should be timely and geographically equitable. There are instances where GMS patients who are high risk are paying for the service – sometimes up to €200. Others wait for up to 6 months.
- A waiting time target of less than 6 weeks should be set.

Facilities:

- Acute hospitals need a comprehensive, dedicated bone service with equipment, facilities and staffing in accordance with evidence based practice. This should be integrated with the hospital's fall prevention service and Primary Care services.

Planning, Quality, Audit, Standards

- The development of bone health services, including DXA scan services, should be planned and developed in accordance with population needs and best practice rather than the current ad hoc evolution which has occurred. This ad hoc evolution of the service has led to the following picture occurring: the scan arrives having been funded by a charitable source - the hospital endeavours to accommodate the machine (though this service development may have been unplanned and unfunded) - the location for the service is found – then staff are rostered or ‘ fit-in’ to provide a service. This is not a satisfactory way to develop a service and it has inherent risks attached.
- Quality Standards and regulations for the delivery and operation of DXA services are urgently needed at national level.
- Only trained qualified personnel should deliver the service as part of a multi-disciplinary team so as to maintain quality and standards. Scanning should be undertaken by radiographers who are trained in the service.
- The service should be audited and evaluated regularly including the technical aspects of the DXA scanning.
- Audit should include criteria for patient referral, protocols for assessment, waiting times, accuracy of diagnosis, treatment, feedback to primary care and reassessment intervals.

Training and Continuing Professional Development

- All health professionals should be trained and take part in continuing professional development to provide this service.
- There is a need for a central repository of training information.
- There should be standardised protocols and external audit of the service.
- Training is needed on the use of the machinery and on machine upgrades.

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