HEALTH IRELAND USERS GROUP

DIABETES AUDIT REPORT 2009

A computer based, automated analysis of process and outcomes of diabetic care in 23 GP practices in Ireland

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EXECUTIVE SUMMARY

The estimated prevalence of diabetes in Ireland by 2015 is 190,000 (IPHA)(3). Although integrated care across primary and secondary healthcare sectors for all diabetics is the goal of the Irish Diabetes expert advisory group (9) increasing prevalence and lack of resources suggest that the management of the majority of type 2 diabetics is likely to continue to be undertaken in general practice. In the UK most type 2 diabetes is successfully managed in primary care and there is good evidence that structured care for diabetics in general practice has as good outcomes as secondary care (12,13). The American Diabetes Association in January 2010 commented that there are several factors associated with practices which provide quality diabetes care including "electronic healthcare records" (21). To date no one in Ireland has assessed the use of "electronic health care records" for the management and audit of diabetes care in general practice.

The Health Ireland Users group is a co-operative of over 700 GPs in Ireland who have used the Health One electronic patient record since its introduction to Ireland in 1992. The groups main functions are to develop the program and to actively support and train the software users. A research group was initiated in 1996 and the first automated audit on hypothyroidism completed in 1999. More recently the advent of improved data analyses functions has allowed us to extract much more detailed information from patient files. Using this we have developed an automated analysis which extracts data on the key indicators of diabetes care from the existing electronic records – running this extraction and exporting the resultant excel file to the research co-ordinator takes only 10 minutes work for the practice personnel involved.

The primary aims of this study were to look at

- The quality, accuracy and completeness of the data extracted using an automated extraction of anonymised data on the key indicators of care from the existing records
- The standard of diabetes care achieved for process and outcomes
- Providing GPs with feedback/audit of their diabetes care and providing them with methods to improve this using their software

We have also developed a new interface for data input and data presentation for diabetic consultations in the patients electronic record and in the 2010 audit we will be assessing if this can improve the data quality as well as further improving the process and outcomes for diabetes care.

Methods

Practices initially had to reach certain standards in terms of software and data entry in order to participate. We then sent the practices an ñanalysisòwhich they imported to their software. This extracted the most recent result for each of the key variables for diabetes and cardiovascular care as well as the date of recording for all patients on the ñtype 2 diabetesòregister and exported this data to an excel file. The variables extracted were Hba1c, cholesterol, LDL, triglycerides, creatinine, BMI, systolic and diastolic blood pressure and smoking status. This anonymised data was then emailed to the data co-ordinator. This data was then both manually and electronically cleaned to remove erroneous results. We looked at the data quality/errors to assess the reasons for these so that we could prevent their occurrence in future audits. Data was then analysed using SPSS.

We looked at both the process and outcomes of care. Each variable was broken down into low medium and high risk groups in accordance with the ICGP national guidelines 2003 which allowed us to compare the results with the DIG, Midlands and UK data.

We carried out the audit without updating diabetic registers. We have subsequently provided practices with analyses to find unregistered diabetics and we will determine in the next audit cycle if registers have improved.

Findings

The quality of the data extracted was very high however the excel files received did have to have some manual cleaning done to remove non numeric data from numeric fields. This occurred for a number of reasons as outlined in Section 3.1 and affected approximately 2% of the results (if we exclude BMI =0 and free text non numeric entries for Tobacco). We have solutions to the majority of these issues which will require some technical changes and some user education on how best to enter data. Use of the new diabetes module should resolve many of these issues.

Process of care

The percentage of valid values recorded as shown below compares well with other audits and shows that the HIUG practices not only check and record these variables but they do so in a very consistent manner and that the analyses which we have designed are capable of extracting this data. The inter-practice variation should provide us with an opportunity to identify issues creating difficulties with data extraction and this will be addressed through both technical changes and user group education meetings. We hope that the use of the medi-forms will significantly improve the consistency of data entry.

Process of care	Audit '09	DIG Audit '08	Midlands Audit '03	England & Wales Audit '05-'06
	% (N)	% (N)	% (N)	%
Blood pressure	83 (1583)	82 (821)	99 (933)	86
HbA1c	83 (1580)	73 (738)	95 (896)	82
Total Cholesterol	88 (1672)	79 (792)	96 (906)	81
LDL Cholesterol	70 (1339)	65 (658)	61 (578)	-
HDL Cholesterol	-	61 (610)	63 (598)	-
Triglycerides	88 (1676)	64 (647)	90 (853)	-
Creatinine	90 (1705)	77 (777)	82 (775)	83
BMI	58 (1103)	38 (382)	55 (517)	-
Smoking	66 (1249)	50 (502)	74 (701)	79

It is somewhat surprising that DIG should have a lower rate of vaccinations as shown below than other groups as it should be possible for computerised practices to more easily identify vaccine defaulters. There are a number of possible cause for this which we will review.

	Influenza vaccine in past 15 months	Pneumococcal vaccine ever
	N **(%)**	N **(%)**
HIUG	1010(54)	796(43)
DIG	636(63)	490(68)

Outcomes of care

Hba1c control is similar to DIG and a little better than the older midlands and UK data.

HbA1c categories comparison with 3 other audits

HbA1c Categories	Audit '09	DIG Audit '08	Midlands Audit '03	England & Wales Audit '05-'06
	% (N)	% (N)	% (N)	%
low risk (<6.5%)	28 (438)	27 (200)	27 (240)	24
medium risk (6.5%-7.5%)	38 (599)	44 (323)	27 (245)	37
high risk (>7.5%)	34 (543)	29 (215)	46 (411)	40
Total	1580	738	896	-

For total and LDL cholesterol the DIG audit is better while for Triglycerides the HIUG group is marginally better.

Lipid profile comparison with DIG audit

Lipid Profile	Audit '09	DIG Audit '08
	% (N)	% (N)
Total Cholesterol mmol/L		
low risk <5	72 (1210)	79 (622)
medium risk 5-6	19 (320)	16 (128)
high risk >6	9 (142)	5 (42)
Total (% recorded)	88 (1672)	79 (792)
LDL Cholesterol mmol/L		
low risk <3	72 (964)	82 (534)
medium risk 3-4	22 (292)	16 (102)
higher risk >4	6 (83)	3 (22)
Total (% recorded)	70 (1339)	65 (658)
Triglycerides		
low risk <1.7	59 (987)	56 (359)
medium risk 1.7-2.2	19 (322)	19 (121)
high risk >2.2	22 (367)	26 (167)
Total (% recorded)	88 (1676)	64 (647)

Comparisons of BMI categories with the DIG group show an almost identical distribution of obesity

BMI category comparison with DIG audit

BMI Categories (kg/m2)	Audit '09	DIG Audit '08

	% (N)	% (N)
underweight <18.5	0.7 (8)	0.3 (1)
normal <25	12 (131)	11 (41)
overweight 25-30	40 (448)	37 (142)
obese 30-40	41 (449)	42 (162)
severely obese >40	6 (67)	9 (36)
Total (% recorded)	58 (1103)	38 (382)

Once again blood pressure control is very similar to the DIG data

Blood pressure categories comparison with DIG audit

Blood Pressure (mmHg)	HIUG Audit '09	DIG Audit '08
	(%)N	% (N)
≤130/80	(31)493	34 (280)
>160/100	(10) 162	10 (78)
Total (% recorded)	(83) 1583	82 (821)

In terms of diabetic outcomes the audit data compare well with the recent DIG audit and are significantly better than the older midlands and UK data. This is remarkable given that this group do not have a professed interest in diabetes but rather an interest in using information technology to improve practice management and patient care. It is all the more remarkable when you consider that there were no specific incentives or support given to this group to improve diabetic care ï the 3 other audit groups all have a diabetic interest and some form of incentives or support for diabetic care.

Interestingly the inter-practice variation (Section 3.4.2) is much more marked than the difference between the 4 different audit groups. To some degree this is predictable as the populations are smaller at practice level however it is hard to imagine that the only factor explaining the marked variations is statistical probability. To summarise the variation

- Well controlled HbA1c (<6.5%) varied from 5% to 55%
- Well controlled cholsterol (<5mmol/l) varied from 57% to 85%
- Well controlled LDL (<3mmol/l) varies from 47% to 88%
- Well controlled systolic BP (<130mmHg) varied from 7% to 52%
- Well controlled diastolic BP (<80mmHg) varied from 15% to 66%

We will be looking closely at the practice factors revealed in the practice questionnaires to see if there are any consistent reasons for such marked variation as well as asking the practices to feedback to us their beliefs as to why their own practice varies from the average in different areas.

Conclusions

Data can be collected using an automated system and for a limited number of the most relevant items and is of a quality comparable to manual data searches. This is remarkable given that there was no pre-defined dataset or data entry method or group of practices for audit. This is a testament to the GPs, their staff and the support and training provided by the Health Ireland Users Group. The ability of the Health One program to record data in a structured way and facilitate such complex audit with minimal workload for clinical staff is a strength that is well recognised by program users but poorly recognised elsewhere despite the strong allegiance of such a large group of GPs for over 18 years.

The HIUG group of practices compare very well with other primary care diabetes audits. This shows that practices with a broad interest in providing quality care and using a quality electronic health care record but with no co-ordinated special interest or support are providing diabetes care on a par with other diabetes groups in Ireland and the UK.

Inter-practice variation is a marked feature of the audit and will be addressed in the next project which is to compare the practice factors (questionnaires already returned by all 23 practices) with the process and outcome measures. The practice feedback reports highlight for each practice their strengths and weaknesses and provide guidance on how to tackle the weaker areas.

The lack of resources to support this audit has been a major obstacle to timely completion of the audit, report, practice feedback, practice training and further development of the mediforms and analyses.

Part of the reason for the high levels of process of care recorded was undoubtedly the semi-structured consultation for diabetes already provided by Health one for many years. Hopefully the new much improved structured record will further improve this but it requires some effort for practices to change their work practices and it behoves the HSE to support such change.

A single patient record for the primary care team would also contribute to higher outcomes for process of care and hopefully for outcomes of care.

1 BACKGROUND

The past decade has seen an international recognition of the increasing prevalence of Type 2 Diabetes Mellitus and the need for new approaches to managing this complex disease. Borgermans et al in a review of "the existing diversity in diabetes care programs and related quality indicators" in 2008 concluded that "high quality diabetes care must be linked to quality indicators at the structure, process and outcome level" (1). We believe that we have put in place the technological capacity to facilitate the structure process and to monitor the process and outcomes of diabetes care in a way which encourages best standards of care.

1.1 Diabetes prevalence and complications

The World Health Organisation (WHO) Global Burden of disease study 2004 estimates an increase in worldwide prevalence of diabetes mellitus from 2.8% in 2000 to 4.4% in 2030(2). In the Irish context the Institute of Public Health of Ireland estimates that the current incidence is 4.7% or over 140,000 diabetics and that this will rise to 5.6% by 2015 giving a total of 190,000 diabetics(3). The Cork and Kerry survey found a 4% incidence in high risk non diabetic patients in the 50-69 age group(20).

Diabetes confers an enormous disease burden due to the high incidence of both microvascular (blindness, renal failure etc) and macrovascular (myocardial infarction, stroke, peripheral vascular disease) complications(4). Recent studies (in particular the UKPDS) have provided concrete evidence that good glycaemic control and controlling other cardiovascular risk factors can prevent or minimise these complications(5).

1.2 Diabetes management models

The challenge for health services is to find a way to provide chronic disease care in an co-ordinated, cost-effective and measurable way. In Ireland the management of diabetes has developed in a disjointed manner with multiple unrelated primary and secondary care initiatives.

Traditionally diabetes management in Ireland centred around a secondary care model. The increasing incidence has led over the past decade to type 2 diabetes being increasingly managed in general practice(6). The Diabetes Interest Group Report 2008 (7) pointed out several reasons for this migration of diabetes management to primary care including-

- Secondary care services for diabetes care are completely inadequate to cope with these numbers leading to longer waiting times and longer intervals between clinic visits
- GPs have through necessity up-skilled themselves on diabetes management
- Practice nurses have been employed more frequently and many practice nurses have undertaken further training in diabetes management

- Increasing range of diabetic services available through the PCCT (including podiatry, dietician, retinal assessment etc)
- Improving patient education services in primary care at both practice level and at a larger level including CODE, EXPERT and DESMOND
- Patients have chosen to attend their GP for their diabetes care as they receive more time and more continuity of care (non-GMS patients are caught in a difficult situation where they bear no cost for secondary care but must pay directly for primary care ï this can be expensive for diabetes care which is labour intensive)

Several studies have shown that the development of systems for quality diabetic care have been hindered by the hospital based acute care model(10,11). In addition there is good evidence that ñstructured careòfor diabetics in primary care is as good as secondary care(12,13). It has also been shown that care provided in the primary care setting can enhance diabetes quality of life without compromising quality of care(14). The debate appears to have moved on from the location of care (primary versus secondary care) to the model of care. In the UK the shift of diabetes management towards primary care is well established and the roles of primary and secondary care are unified through the National Service Framework for Diabetes(15). In addition the pay for performance incentives in the quality and outcomes framework (QOFs) have had a positive impact on both process and outcomes of diabetes care(16).

Several structured care and shared care programs for diabetes have already been rolled out across the country and have shown how successfully primary care can manage chronic diseases such as diabetes(7,12). The structure of these programs in terms of numbers of patients, staff, funding and audit is outlined in Appendix 2. What is clear is that these programs are all run by committed primary care staff with substantial variations in HSE support, funding and audit. Despite having 10 such initiatives across the country only a small percentage of the diabetics nationwide are covered by these programs. Recently a survey of general practitioners on the organisation of diabetes care in general practice was undertaken by the ñNational Diabetes Register Projectò(8). Amongst other findings they noted that only 45% had a diabetic register and only 30% had formal recall. They concluded that the delivery of diabetes care in Ireland remains largely unstructured and that key challenges to improving diabetes care appear to extend to the system and organisational level of care delivery. Electronic patient registration is one of a variety of quality improvement strategies and is fundamental to a high quality diabetes management system(19).

The American Diabetes Association in January 2010 made extensive revisions to the section "Strategies for Improving Diabetes Care" based on newer evidence. Successful strategies to improve diabetes care, which have resulted in improved process measures such as measurement of A1c levels, lipid levels, and blood pressure, include the following:

- Delivery of diabetes self-management education.
- Adoption of practice guidelines developed with participation of healthcare professionals and having them readily accessible at the point of service.
- Use of checklists mirroring guidelines, which help improve adherence to standards of care.
- Systems changes, including providing automated reminders to healthcare professionals and patients and audit and feedback of process and outcome data to providers.
- Quality improvement programs, in which continuous quality improvement or other cycles of analysis and intervention are combined with provider performance data.
- Practice changes, which may include access to point-of-care A1c testing, scheduling planned diabetes visits, and clustering dedicated diabetes visits into specific times.
- Tracking systems with either an electronic medical record or patient registry to improve adherence to standards of care.

The ADA commented that "The most successful practices have an institutional priority for quality of care, involve all of the staff in their initiatives, redesign their delivery system, activate and educate their patients, and use electronic health record tools"(21).

The recent report of the ñExpert Advisory Group on Diabetesò(9) has proposed a future system of ñintegrated careòbetween primary and secondary care. The roll out of Diabetes Service Implementation Groups (DSIGs) in some HSE areas has started the process of implementing some of these structures. However the roll out is not currently happening in a co-ordinated or consistent manner. The ñintegratedòcare across the primary/secondary care sectors aspired to in the EAG report will require substantial extra resources at both primary and secondary care level and the current manpower and financial challenges will make this development unlikely. In these circumstances it would appear that the current situation where the majority of type 2 diabetics are cared for in primary care is likely to continue.

The evidence that this care needs to be ñstructuredòis incontrovertible. In addition it will have to be backed up with evidence of process and outcomes achieved requiring ongoing audit. We have developed an integrated solution which provides the technical facilities for structured care and a very user friendly system for audit which involved very little work for clinical staff to monitor diabetes management in primary care.

The motivation for developing this computerised system for managing and auditing diabetes care in general practice was complex but included the following

- Increasing numbers of diabetes patients
- Many more diabetics being managed solely in primary care
- A perceived need for a simple integrated system within the patients computerised file which would facilitate
    - Prompts for relevant clinical assessment and management
    - Data entry
    - Automated flow sheets for diabetes care
    - Data audit
- A desire to maximise the integration of diabetes care at GP level
- A desire for audit and transparency

1.3 Health Ireland User Group

1.3.1 Health One Software

The Health One patient management software was first developed in the late 1980s to comply with the emerging Global and European standards in electronic healthcare records (GEHR).
A group of pioneering Irish doctors set out in 1992 with the aim of developing a suitable Practice Management System for use by doctors. The group quickly identified the already established Health One system as the most suitable solution available and set about developing specific functionality required by Irish GPs.

1.3.2 User Group

The Health Ireland User Group (HIUG) was then set up to co-ordinate the development of this functionality.
Today HIUG has a membership of over 700 GPs, which makes it the largest and most active user group of its kind in Ireland. The active nature of this user group and the fact that it comprises practicing GPs who use the clinical software every day has meant that the GPs have been able to ensure that the product continues to adapt to the changing needs of Irish healthcare.
HIUG co-ordinates and provides ongoing training for GPs, nurses and administrative staff who use the software. This is done regionally on a voluntary basis by advanced users of the

software for the benefit of all software users. In addition the User Group has an AGM each year where training, product developments, future direction etc. are discussed.

1.3.3 HIUG – History of research and audit

The idea of a computer research network in the Health Ireland Users Group was first discussed in December 1996. At the HIUG AGM in 1997 it was agreed that the idea of a research network should be further developed and to this end a research and education committee was elected. The committee were aware of the problems with inconsistency in data entry and the first requirement of the project was to review how data was recorded and how this could be improved. In 1997 we undertook a questionnaire survey of all the Health Ireland Users Group members to assess the nature of the information maintained on their computers and their interest in a research network. The steering group undertook a visit to the Doctors Independent Network in the UK in 1997(an independent computerised GP audit and research group). In 1998 the steering group developed a set of guidelines with the assistance of the ICGP and the Data Protection Commissioner which outlined how data would be gathered and shared and these guidelines were disseminated to all participating practices(Appendix 1).

The aims of the project were as follows:

1) To develop a framework for multi-practice research and audit in computerised primary care practices.

2) To encourage individual participants to develop research ideas through support and assistance in project development.

3) To encourage evidence based practice through the use of computer based clinical protocols and guidelines.

1.3.3.1 Survey of computer usage amongst HIUG members – 1997

(Presented as a paper at WONCA 1998 by Dr Michael Joyce)

The questionnaire was designed with two parts. Part one assessed the practice profile using the same questions used in the ICGP manpower questionnaire. The second part of the questionnaire assessed the current use of the computers amongst Health Ireland Users including hardware, software and the data recorded both in terms of the amount of data and the methods of recording used.

A total of 87 practices replied to the questionnaire giving a 52% response rate. Of these 87 practices 61 were either completely paperless or using the computer most of the time. From this survey a cohort of practices willing and potentially technically capable of participating in an automated audit was collated.

1.3.3.2 Thyroid Audit 1998/1999

(Published in Forum April 2000(15) and presented as a paper at WONCA 2000 by Dr Frank Hill)

This was a pilot project to test the feasability of an automated audit of data in multiple practices using Health One software.

A specially written software program was designed to automatically extract anonymised data from practice computers onto a floppy disc. Hypothyroidism was chosen because it is a common general practice problem where a limited amount of data extracted would allow us to ascertain the prevalence of the condition and the appropriateness of management of thyroid function results .

51 practices , who use the Health One software program were recruited. All GPs initially agreed to participate but 20% subsequently withdrew due to the workload involved in completing the accompanying questionnaires. In a further 20% of practices, not all the required information was accessible.

In the study population the prevalence of hypothyroidism was 1%. The management of hypothyroidism was assessed for the 7 practices who had a total of 20 or more TSH results extracted onto their disc.

Problems which reduced the value of recorded data include poor software, ill-defined practice populations, inconsistent data input and lack of coded data. We concluded that the use of standardised case report forms integrated to the patients computerised record and user group training to standardise data entry would improve data quality. While we could develop standardised data entry sequences these were not very intuitive, very difficult to disseminate to practices and did not have the clear and immediate benefits to practice needed to encourage practices to put in the work needed to develop these at practice level.

1.3.3.3 Diabetic Audit and DIABCARE – 2002-2003

In 2000-2001 Dr Frank Hill and Dr Rory O'Driscoll began to look at developing the software to extract clinical data relevant to diabetic management for each individual patient in the whole practice population in one easily executed analysis. The concept was to do this in conjunction with Diab-care a European project which offered the opportunity to get automated audit and feedback on this data.

The aims were to

- To establish whether existing computerised record systems in general practice could be modified to permit effective audit and continuous quality assurance without unmanageable workload implications
- Participate in a European project on diabetic care to compare data and performance
- Develop a protocol for diabetes management integrated to the Health One Patient Care software and based on the ICGP Diabetes Guidelines including

- A checklist of relevant items to be completed with automatic lists of likely results in a coded and thus analysable format
- Automatic prompts for abnormal or due items
- Automatic recall for due visits
- A tabular display of relevant items for reviewing ongoing care
- Automatic data outputs for exchanging information with other professionals within shared care initiatives.
- Analyses for audit of patient and practice data.

- Improve Diabetic Care for patients

The development achieved the capacity where a single analysis could find the diabetic patients and then extract pre-selected items to an excel file. The data chosen were , Hba1c, creatinine, sytolic BP, diastolic BP, weight and fundal examination. This worked perfectly in the developers practices but the same problems which were highlighted in the thyroid study made implementation at a broader level a difficult task. In particular

- Analyses could not be shared between practices ï they had to be re-written individually in each practice which required both time and expertise
- Sequences (the system used for checklists)could not be shared between practices.
- Automated prompts and recalls were not currently possible in the software
- Tabular display existed but was difficult to format and to access

Substantial funding was required for both the software development and for the remuneration of the participating practices. Applications for funding were unfortunately unsuccessful and the project had to be shelved.

1.3.3.4 Influenza Surveillance Network

The national disease surveillance network commenced in October 2000. This was a collaborative project between the HPSC (Health Protection Surveillance Centre) the NVRL (national Virus Reference Laboratory) and the ICGP (Irish College of General Practitioners). This was to monitor the incidence of certain diseases with a particular emphasis on influenza in the community. A previous paper based system had failed to achieve the objective of accurately measuring community incidence and it was a felt a move towards using computerized practices was the way forward. At the time Health One and in particular the user group was approached to see if the project objectives could be met using a selection of twenty Health One practices and the expertise of the user group. We were able to build on the success that had already taken place with the user group research network. The project was an instant success and has continued to operate and expand since. The network now contains over sixty practices, the majority, over 90% are still Health One practices as this technology is ideal for the

purpose. The network has now established base line influenza levels for Ireland and is an essential part of the community surveillance of influenza as proved during the recent swine flu epidemic.

1.3.5 –Developments leading to the current research project

HIUG has continued to be interested in developing the software for both chronic disease management and audit/research. However realising this potential required further developments in the software which have gradually been implemented.

As practicing GPs, members are very cognisant of several changes currently occurring in general practice including

- the increasing role of general practice in chronic disease management
- the complexity of such management and the need for guidelines and protocols to achieve best care
- the need for integration of care across the PCCT and with secondary care
- the need for audit and transparency in assessing this care
- the need to avoid double entry sytems and stand alone software packages as occurred with Heartwatch

It is generally accepted that amongst the patient care systems available the Health One software has the most advanced and flexible capacity for auditing and analysing the data in the patient files both at individual patient level and at population level. However for this capacity to be truly useful it requires that the data be input in a more structured way. The functionality to achieve practical structure input was provided by the software company in 2007 and was called a mediform.

The mediform-interface for each chronic disease is developed by a small group of highly motivated GP users who do this in their spare time for the purely altruistic reason of improving patient care. These interfaces are then provided to other users free of charge. Each interface is an evolving process as the guidelines change, the audit datasets change and the users provide feedback on what does or does not work for them in the real clinical setting. When the users import a new version of a mediform it will work seamlessly with older versions and with even older data in the patient file.

1.3.5.1 Mediforms

Mediforms have multiple advantages including the following

- They can be designed and edited by users for users
- They can be easily distributed and shared amongst users
- They provide the ability to incorporate protocols and guidelines into patient management software including
    - Ckecklists (eg ï has patient attended opthalmology, dietician etc)

    - Information boxes (eg current guidelines for waist hip circumference in men and women)
    - Target values (eg Hba1c) etc
- They have the capacity to extract data from the patient file and can thus automatically display on one page a list of the patients Hbaics, lipids, BPs, BMIs etc. as well as the patients current meds, medical history etc to create an automated flowchart to simplify and improve patient management.
- They increase standard data input which facilitates both quality of clinical care and audit of this care.
- They can have linked printed documents which will also incorporate data from the patient file automatically ï in the case of diabetes this can be used to print for a patient an individualised patient management plan.
- They can have built in links to useful web pages for the GP or the patient.

1.3.5.2 Analyses

The newest version of the Datawarehouse Analyses in Health One are user definable and easily exported and imported by different users. A recent addition is the capacity to extract a defined dataset from a group of patients found by a Health One analysis. These 2 developments in analyses have made it possible to easily provide many users with the capacity to automatically extract a preset collection of data from patient files into a preset format in excel which can then be sent to a central computer for analysis.

With the development of these analyses and the more consistent and thorough data input through mediforms we now have the potential to do high quality automated audits of disease management in Health One.

2 METHODS

2.1 Study overview

This study arose out of an initiative of the GP members of the Health Ireland User Group and was first presented as a potential project to the AGM of the HIUG in Nov 2007. One year later the results of a pilot audit were presented to the AGM in Nov 2008. Having confirmed the technical feasibility of such an automated audit of diabetic management it was agreed to run the initial phase in 20 practices. This has since risen to 23 practices and there are 5-6 more currently being assisted with data collection however the lack of funding for the data analysis undertaken by UCC has prevented the further roll-out of the audit nationally.

2.1.1 Aims and Objectives

- Using a completely automated search function -ascertain what data regarding the diagnosis and management of diabetes can we currently extract from the patient file

system using the Health One software?

- Determine the quality/accuracy/completeness of this data?
- Ascertain what changes are needed to improve the quality of the data extracted in future
- Determine the current standard of diabetic care in a group of general practices with no professed special interest in diabetes care
- Determine if the introduction of Mediforms improves the quality of the data extracted.
- Feedback individually to each participating practice on how the practice compares to colleagues in HIUG and on how the practice and HIUG users compare to other sample populations
- Determine if the standard of care is improved by the implementation of Mediforms and this program of audit

2.1.2 Practice requirements

In order to participate practices will need to achieve a relatively high standard of computerisation including

- Record all your consultations and lab reports on the computer
- Be using version 6 or later of Health one
- Be using an SQL data source
- Have a copy of Microsoft Excel on your computer

This degree of computerisation may seem difficult to achieve if you are looking at computerisation levels in secondary care and in other areas of the primary care team however the majority of Health One Users are very highly computerised and will reach these criteria.

2.1.3 Diabetic Register

For our purposes Type 2 Diabetic patients are those who have the term ñdiabetes mellitus type2 (NIDDM)òrecorded in the basic medical information page under the items medical history, problem or diagnosis (ICD9-CM)(this is how GPs have been advised to keep chronic disease registers at User Group training meetings). We carried out this audit without getting practices to review or update their diabetic register.

However we also provided participating practices with three computer analyses that will find patients who are not currently correctly recorded as diabetics but who probably are diabetic (i.e. are on diabetic medication or have glucose readings above a certain number or have a different diabetes term used in their file). These 3 searches provide practices with lists of possible diabetics which they could then manually enter correctly as diabetic for the diabetic register. In our experience this system is over 99% effective in finding diabetic patients in the practice computer database. When we re-audit in 2010 we will be able to assess how much the diabetic registers have improved

2.2 Pilot Project

A pilot project was carried out in 2007 to test the feasibility of extracting the audit data. We decided to invite practices where we were aware that the GP had an interest in IT to increase the likelihood that they would be able to quickly recognise and resolve any technical problems arising. A group of 10 practices were individually invited to participate. We were able to get completed returns from 9 out of the 10 practices within 3 weeks. This total data for each practice was summarised and presented at the HIUG AGM in Nov. 2008.

An open invitation was then issued to all members of the HIUG to participate in this project after the AGM in 2008. There were no criteria for participation apart from fulfilling the technical criteria as described above. Over 50 practices expressed an interest. 23 practices progressed to complete the initial data extraction and returned anonymised data to the central database held by Dr Hill.

2.3 Technical Problems /Solutions

SEE APPENDIX

2.4 Data Collected

For each practice ,individual patient data was extracted to an excel file by a member of the practice staff. This data was anonymised as it was extracted however sex and date of birth were extracted to allow practices (if they so chose) to identify individual patients where they deemed further intervention might be warranted based on the results extracted. Running the analysis to extract the data and sending this anonymised result to the data centre should not take the staff member more than 10 minutes. The most recent occurrence of the following items were extracted along with the date of this item:-

- HbA1c
- Glucose
- Creatinine
- Total cholesterol
- LDL cholesterol
- Triglycerides
- BMI (Body mass index)
- Systolic BP

- Diastolic BP
- Smoking status recorded in consultation

In addition smoking status as recorded in the patients summary page was extracted though it was not possible to extract the date on which this had last been updated.

These items were chosen as :-

- These were the main risk factors referred to in the national diabetes guidelines 2008 (Ref 18).
- They were likely to be recorded in a consistent manner in the patient file
- Values recorded for these items were likely to be numeric thus easier for automated analysis.
- We felt that these were the items most relevant to the GP when managing a diabetic patient in the consultation and thus most useful for practice reports provided as part of the audit process.

2.5 Data Analysis

The audit data from Excel was imported to SPSS for Windows (version 15) for coding and analysis. Analyses were conducted on the 23 practices which included data on 1,901 patients with Type 2 Diabetes. In SPSS, descriptive statistics undertaken for analyses included frequencies and crosstabs. The variables collected include gender; age; HbA1c (%); total cholesterol (mmol/L); LDL cholesterol (mmol/L); trlglycerides; body mass index (BMI); systolic blood pressure (SBP); diastolic blood pressure (DBP); and smoking. Continuous variables were recoded resulting in all categorical variables. The recoded values can be seen in the table below. The variables are classified into risk categories according to the ICGP guidelines (2003). There are missing data on a number of variables throughout the report. Where this occurs the figures represent the count and percentages of recorded data.

Table 1 ï Risk categories for each variable ï ICGP guidelines and SPSS value ranges

Values (ICGP guidelines)	Recoded values in SPSS
HbA1c:	
1 - <6.5 low risk	1 - Ò6.49
2 - 6.5-7.5 medium risk	2 - 6.50-7.50
3 - >7.5 high risk	3 - Ó7.51
Total Cholesterol:	
1 - <4.5 low risk	1 - Ò4.99
2 - 5-6 medium risk	2 - 5.00-6.00

3 - >6 high risk	3 - Ó6.01
LDL Cholesterol:	
1 - <3 low risk	1 - Ò2.99
2 - 3-4 medium risk	2 - 3.00-4.00
3 - >4 higher risk	3 - Ó4.01
Triglycerides:	
1 - <1.7 low risk	1 - Ò1.69
2 - 1.7-2.2 medium risk	2 - 1.70-2.20
3 - >2.2 high risk	3 - Ó2.21
Body Mass Index:	
1 - <25 normal weight	1 - Ò24.9
2 - 25-30 overweight	2 - 25.0-30.0
3 - 30-40 obese	3 - 30.1-40.0
4 - >40 severely obese	4 - Ó40.1
Systolic Blood Pressure:	
1 - <130 low risk	1 - <130
2 - Ó160 high risk	2 - Ó160
Diastolic Blood Pressure:	
1 - <80 low risk	1 - <80
2 - Ó100 high risk	2 - Ó100

2.6 Data Presentation

In each section we endeavour to present the data in the following order

1. **The total data for the 23 practices combined**. This is presented as the average result for the whole group

2. **The inter-practice variation**. This is presented as a comparison of the average results for each practice. A bar graph is generally used to present this data for all 23 practices in one graph in order to make inter-practice variation for each item easy to appreciate at a glance.

3. **The comparison with other 3 other audits** on diabetes care. The other audits which we compared our data to are

   DIG ï Diabetes Interest Group (2008) ï a Cork based group of GPs with an interest in diabetes care(7)

   Midlands Diabetes Audit (2003) ï a group of GPs in the midlands who have been involved in a HSE sponsored program for structured diabetes care(12).

   National Audit for diabetes England and Wales(2006) ï an multicentre audit of diabetes care including over 16,000 patients(16)

When looking at process of care outcomes we chose to look at items recorded in the past 12 months. This is the same time interval used in the midlands and UK audits unlike the DIG audit which only accepted items recorded in the past 6 months for most items. All four audits refer to primary care data only.

3 RESULTS

3.1 Data Quality

When the anonymised excel files were received these were manually reviewed for obvious data errors. A number of real or potential data errors were identified during this process. The sources of errors and the steps taken to correct the data are as follows:-

- Text in a numeric field ï this occurred in about one percent of all fields. Examples might include a blood pressure recorded as ñ140 seatedòor a glucose as ñ7 non-fastingò These were corrected by deleting the text.

- Empty fields- The extraction found the most recent occurrence of an item such as Hba1c and if this item had no result input (had been left blank in the file) then the field in the extraction would be blank. This date of the most recent apparent record of this item was also the date of this blank item and thus inaccurate. On reviewing the data this occurred mainly in relation to a very small number blood pressure readings. For labs this may mean that the item was not done but for clinical items like SBP it almost certainly was done but the last occurrence was blank. This would vary between practices depending on the settings in the software and it is a simple procedure for practices to change the settings to auto-delete empty items. We will show practices how to do this in advance of future audits.

- Heartwatch ï the heartwatch program had required practices to record spurious results into the patient file. For example items such as Hba1c were picked up with a recurring value of 99.99 in some practices participating in heartwatch. Unfortunately we had to treat these empty fields for analyses purposes.

- Hba1c ï this has been analysed by 2 different lab protocols in a small number of areas thus leading to some confusion re accuracy of Hba1c results in these practices. The protocol used was sometimes written in text beside the result. We decided to delete the text and to treat all Hba1cs the same as it was a small percentage of patients in a small number of practices. The use of 2 protocols is being phased out nationally so this problem will decrease or disappear for future audits

- ñTobaccoòin the patients summary page was often recorded as text such as ñcigarettes 20òor ñnil since 1997òetc. ñCigarettesòwas recorded in very few patients consultations as historically we had edited the summary page rather than recording it in the current consultation. We decided to define patients as smokers or non smokers and manually edited the smoking to one column with ñ1òfor smokers and ñ0òfor non-smokers for ease of analysis.

- Blood pressure ï where practices recorded ambulatory or home blood pressure readings in the same systolic blood pressure item as clinic readings the occasional patients have these as the last recorded blood pressure. This occurred in a very small % of patients and we treated all blood pressure readings as clinic readings for the purposes of the analyses .

- BMI -A significant number of BMIs have a result of ñ0òï this is due to the automatic calculation option which some practices have activated and occurs where there is a weight recorded in the consultation but no height recorded at any point in the patient chart. Also noticed a very occasional spurious BMI results where height was input in cm thus misleading the automatic calculation.

A review of the corrections made during the manual clean of the data revealed that many possible sources but usually involved text which would appear to have been added to the result field by the practice staff for reasons of clinical clarity. This added text could be categorised under the following headings

  - Normal range for the item
  - Units of measurement for the item
  - Methodology for the measurement - DCCT
  - Comment re fasting or not
  - Comments re where test done
  - Comments re date test done
  - Comments re whether improving or disimproving
  - % sign often used
  - + or ï sign often used
  - With blood pressure comments re whether ambulatory or not
  - Automatic lab comments in result (particularly practice 15 in relation to LDL)
  - We also noticed a very rare field where the value was clearly erroneous such as an additional digit in blood pressure or a miscalculated BMI due to an error in the height units (using cms rather than metres).

The following tables show a breakdown of the data errors/data cleaning

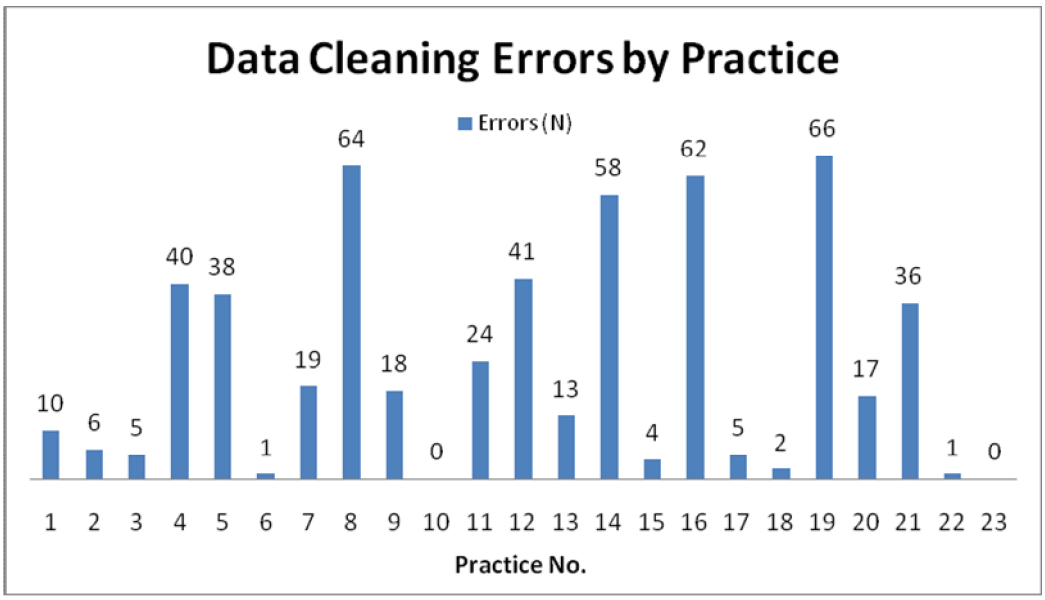

Figure 1

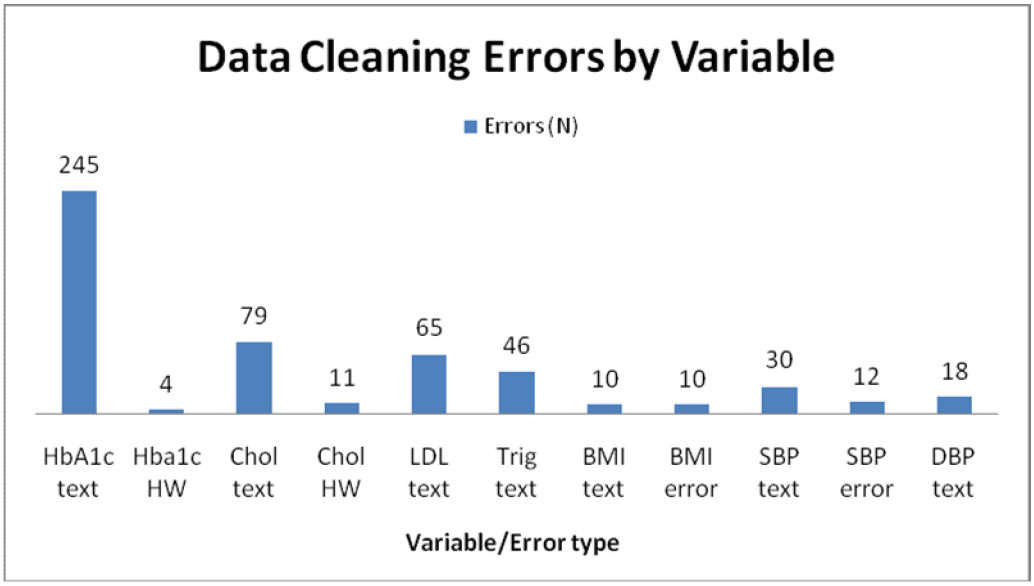

Figure 2

Table 2 - Outliers - When the automated analysis of the data was done any possible outliers were identified. The ranges which we chose for each variable outside of which the value would be disregarded are as follows

Variable	Range of Values
Blood Sugar	1-40
Creatinine	40-500
Total Cholesterol	1-20
LDL Cholesterol	0.5-15
Triglycerides	0.1-30

Body Mass Index	10-100
Systolic Blood Pressure	50-260
Diastolic Blood Pressure	30-150

Table 3 - Outliers that were removed

Variable	Practice No. (& value removed)
Blood Sugar	5 (.00, .00); 6 (.00, .80); 14 (.00); 19 (.00)
Creatinine	3 (0); 5 (5); 6 (39); 8(6, 36); 13 (0, 0); 18 (39); 1 (567); 3 (619); 5 (664); 19 (503)
Total Cholesterol	2 (.7); 8 (.0, 26.0)
LDL Cholesterol	3; 7; 11; 14; 18; 21 (All .0)
Systolic Blood Pressure	7 (500, 500)
Diastolic Blood Pressure	4 (0); 7 (10, 10)

3.2 Study Population

Total population numbers

There were 1901 patients with diabetes included in the analyses.

There was significant variation across the practices in terms of the total number of patients on the diabetic register. Anecdotally this reflects different practice demographics in many cases but in some cases may be related to the accuracy of the diabetes register. This will become apparent in the audit in 2010 when practices have had the opportunity to update their registers.

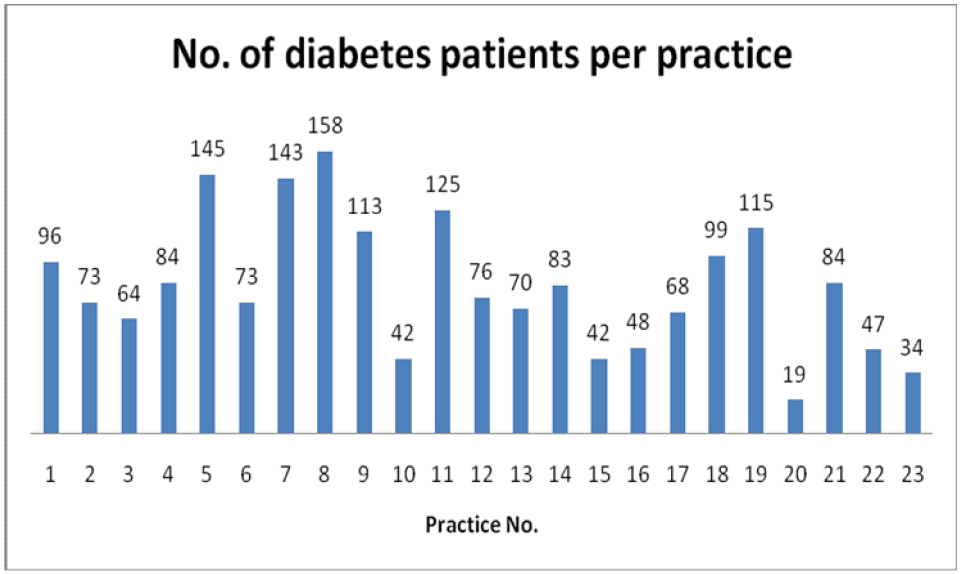

Figure 3

Gender and Age

40% of these patients were female (n=762) and 60% were male (n=1126).

Almost half of the patients (48%) were in the 65-84 year old age group (n=913) followed by 42% in the 40-64 year old age group (n=801). The remaining 10% of patients were in the youngest age group, i.e. 0-39 years, (3%; n=56) and the eldest age group, i.e. >85 years, (7%; n=131).

Table 4 **Age / Gender Groups**

Gender	<39 years % (N)	40-64 years % (N)	65-84 years % (N)	>85 years % (N)	Total
Female	3 (25)	39 (296)	47 (360)	11 (81)	762
Male	3 (31)	44 (501)	48 (544)	4 (50)	1126
Total	3 (56)	42 (797)	48 (904)	7 (131)	1888

The age and gender breakdown is remarkably similar to that found in the DIG data.

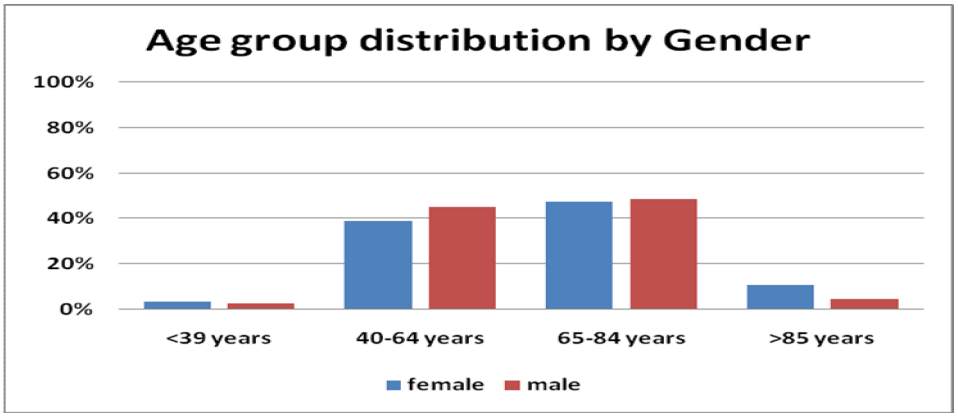

Figure 4

3.3 Process of Care

3.3.1 Percentage valid data extracted

3.3.1.1 Total HIUG Population

There was some valid data for over 99% of all patients found by the automated search of the patient databases. The percentage of extracted versus missing data fields for each of the main outcome measures is shown in figure 3 below. Not surprisingly BMI is the least well recorded item as it used to require a manual calculation. However this can now be automatically calculated in Health One if you enter a weight and there is a height already recorded previously in the patient file. Variation in lipids reflects lab variations rather than practice issues.

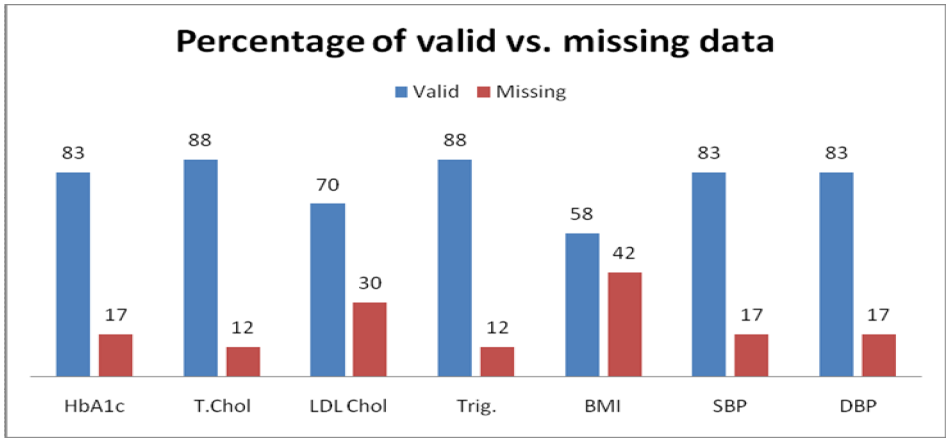

Figure 5

3.3.1.2 Inter-practice variation

Table 5 - Percentage valid data for each variable for each practice

Practice No.	HbA1c	T. Chol	LDL Chol	Trig.	BMI	SBP	DBP	Smoking
	%	%	%	%	%	%	%	%
1	82	80	80	88	85	88	88	79
2	64	78	69	75	32	92	92	66
3	92	98	83	98	52	97	97	67
4	77	91	74	85	31	92	92	81
5	79	95	18	96	27	50	50	57
6	93	99	97	97	92	93	93	96
7	94	93	95	95	90	95	95	90
8	82	87	2	95	47	81	81	66
9	93	97	91	97	65	81	95	94
10	93	93	93	93	91	98	98	88
11	90	90	86	90	78	78	77	9
12	67	84	76	88	79	96	96	34
13	73	94	91	79	83	89	89	74
14	81	88	78	87	59	81	81	69
15	83	88	88	88	62	38	38	26
16	94	96	92	96	17	85	85	48
17	93	99	97	100	90	96	96	82
18	82	89	85	87	49	93	93	86
19	70	49	41	49	10	84	84	61
20	84	90	90	90	79	90	90	89
21	92	99	94	98	45	68	68	14
22	96	96	89	92	85	89	89	81
23	44	50	44	50	21	50	50	82
Total	**83**	**88**	**70**	**88**	**58**	**83**	**83**	**66**

Table 4 shows that there is marked variation between practices in terms of the percentage of patients who have valid data recorded for each variable in the past 12 months. There are several reasons for the variations including , not done, done but recorded under a different

heading and possible technical errors in the data extraction. As an example Figure 4 shows significant variation in valid Hba1c results between practices. Some of this may be due to lab integration problems. Likewise Figure 5 shows enormous variation in recording tobacco consumption which probably reflects a lack of recording but even more likely recording in formats not suited to automated data extraction.

Figure show in graph form the variation between practices in terms of % data recorded for Hba1c and smoking respectively

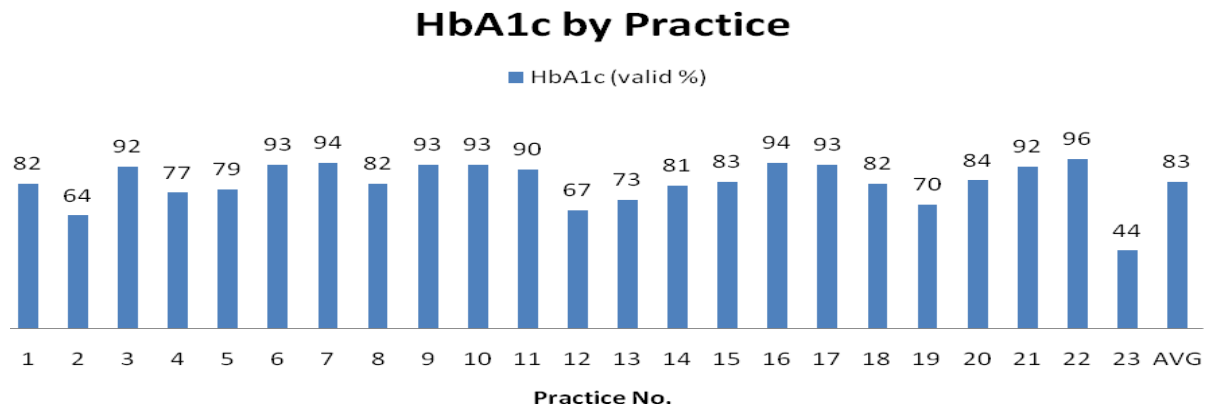

Figure 6

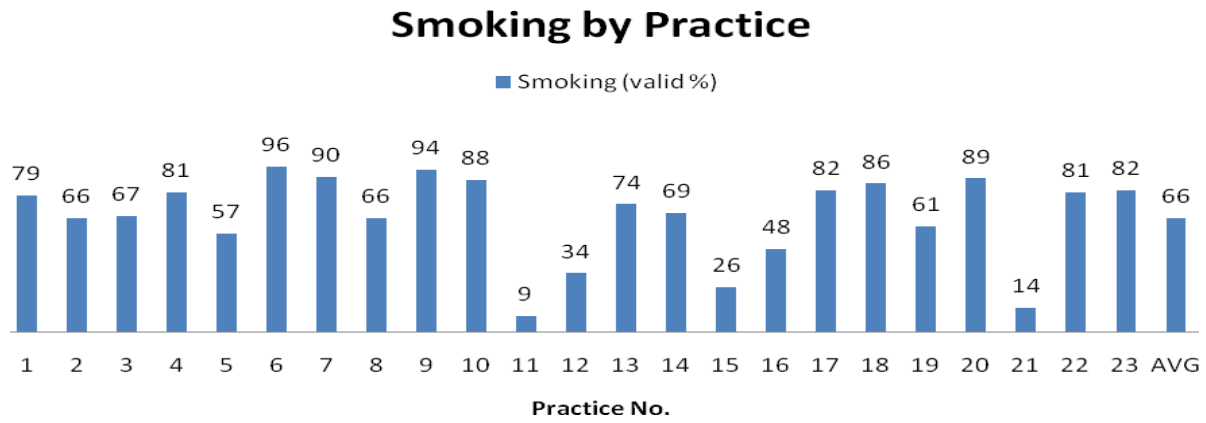

Figure 7

3.3.1.3 Comparison with other audit sites

As stated earlier in section 2.6 on data presentation we have endeavoured to compare our process and outcome measures with similar primary care audits. As can be seen from Table 4 the results of the HIUG Audit compare very favourably with the other audits in terms of process of care apart from the midlands study which scored markedly better than all the other audits in relation to recording of blood pressure, HbA1c and total cholesterol.

Table 6 **Process of care recording, comparison with 3 other audit sites (Type 2 diabetes for Audit 2009 and DIG Audit 2008; Type 1 and Type 2 diabetes combined for the remaining 2 audit sites):**

Process of care	Audit '09	DIG Audit '08	Midlands Audit '03	England & Wales Audit '05-'06
	% (N)	% (N)	% (N)	%
Blood pressure	83 (1583)	82 (821)	99 (933)	86
HbA1c	83 (1580)	73 (738)	95 (896)	82
Total Cholesterol	88 (1672)	79 (792)	96 (906)	81
LDL Cholesterol	70 (1339)	65 (658)	61 (578)	-
HDL Cholesterol	-	61 (610)	63 (598)	-
Triglycerides	88 (1676)	64 (647)	90 (853)	-
Creatinine	90 (1705)	77 (777)	82 (775)	83
BMI	58 (1103)	38 (382)	55 (517)	-
Smoking	66 (1249)	50 (502)	74 (701)	79

The Diabetes Interest Group may appear to do less well in places partly because it only accepted items recorded in the past 6 months while the other 3 audits accepted items recorded in the past 12 months.

3.3.2 Vaccination recorded

3.3.2.1 HIUG Population

Table 5 shows the average vaccination rates for the HIUG audit population as well as the percentage vaccination for each practice. The influenza vaccination rates vary from 30% to 82% while the pneumococcal vaccination rate varies from 3% to 82%. We believe that vaccinations are recorded in a consistent manner across practices and that the inter-practice variation is genuine.

Table 6 **Vaccinations recorded for all HIUG practices and for each individual practice**

	Influenza vaccine in past 15 months	Pneumococcal vaccine ever	Total diabetes patients
	N **(%)**	N **(%)**	N
Total HIUG	1010(54)	796(43)	1869
Practice			
1	51 **(53)**	52 **(54)**	96
2	44 **(75)**	16 **(27)**	59
3	39 **(60)**	43 **(66)**	65
4	25 **(30)**	16 **(19)**	84
5	69 **(48)**	4 **(3)**	145
6	53 **(73)**	41 **(56)**	73
7	84 **(59)**	96 **(67)**	143
8	69 **(44)**	48 **(30)**	158
9	74 **(65)**	93 **(82)**	113
10	19 **(45)**	11 **(26)**	42

11	74 **(59)**	77 **(62)**	125
12	63 **(82)**	57 **(74)**	77
13	46 **(66)**	41 **(59)**	70
14	40 **(48)**	28 **(34)**	83
15	27 **(64)**	12 **(29)**	42
16	25 **(52)**	12 **(25)**	48
17	19 **(28)**	24 **(35)**	68
18	64 **(65)**	57 **(58)**	99
19	36 **(31)**	22 **(19)**	115
20	15 **(79)**	11 **(58)**	19
21	36 **(43)**	7 **(8)**	84
22	21 **(45)**	15 **(32)**	47
23	17 **(50)**	13 **(38)**	34

3.3..2.2 Comparison with other studies

Table 6 shows that HIUG practices have a significantly lower vaccination than DIG practices for both influenza and pneumococcal vaccines.

Table 7 Vaccinations recorded - comparison with DIG audit(Type 2 diabetics)

	Influenza vaccine in past 15 months	**Pneumococcal vaccine ever**
	N **(%)**	N **(%)**
HIUG	1010(54)	796(43)
DIG	636(63)	490(68)

3.4 Outcomes of care

The analyses extracted the most recent result in the chart for each of the outcome variables. When assessing the process of care above we calculated the percentage valid results in the past 12 months but for the outcomes of care we looked at the most recent result even if these were more than 12 months old.

3.4.1 Total population

3.4.1.1 HbA1c:

For HbA1c there was valid data on 83% of patients. Of these, there were 438 patients (28%) in the low risk category; 599 patients (38%) in the medium risk category; and 543 patients (34%) in the high risk category.

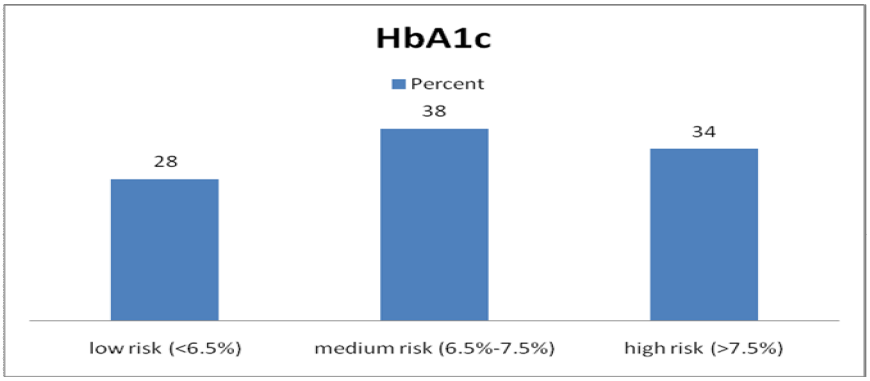

Figure 8

3.4.1.2 Lipid profile

For total cholesterol there was valid data on 88% of patients. Of these, there were 1210 patients (72%) in the low risk category; 320 patients (19%) in the medium risk category; and 142 patients (9%) in the high risk category.

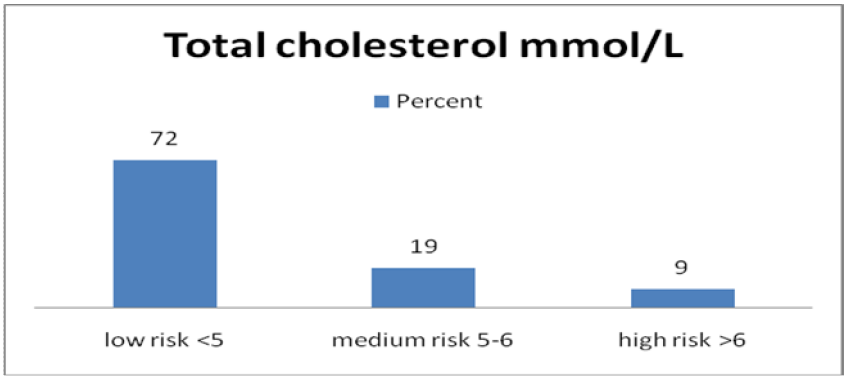

Figure 9

For LDL cholesterol there was valid data on 70% of the patients. Of these, there were 964 patients (72%) in the low risk category; 292 patients (22%) in the medium risk category; and 83 patients (6%) in the high risk category.

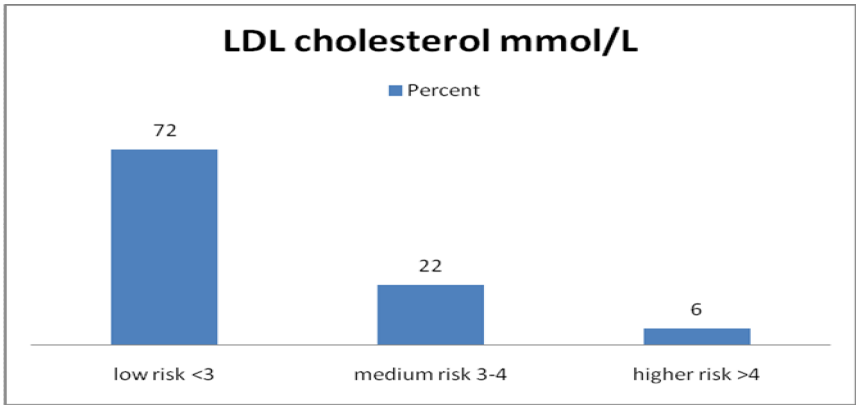

Figure 10

For triglyceride levels there was valid data on 88% of the patients. Of these, there were 987 patients (59%) in the low risk category; 322 patients (19%) in the medium risk category; and 367 patients (22%) in the high risk category.

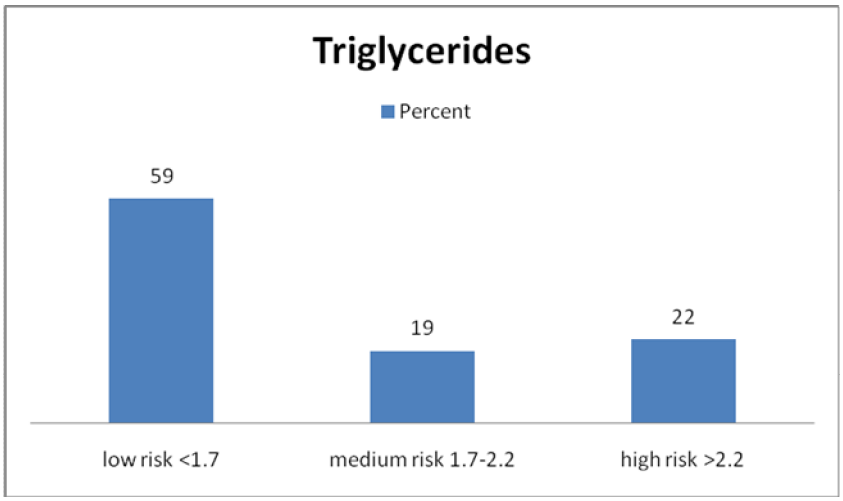

Figure 11

3.4.1.3 Body Mass Index (BMI):

For BMI there was valid data for 58% of the patients. Of these, there were 139 patients (13%) in the normal weight category; 448 patients (40%) in the overweight category; 449 patients (41%) in the obese category; and 67 patients (6%) were severely obese.

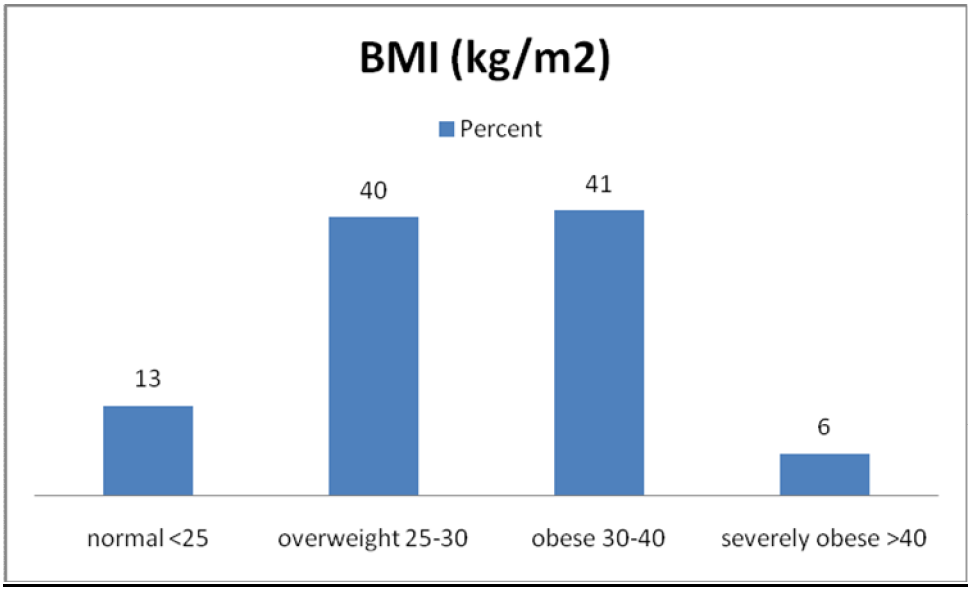

Figure 12

3.4.1.4 Blood Pressure:

For systolic blood pressure there was valid data for 83% of the patients. Of these, there were 410 patients (26%) with systolic blood pressure less than the recommended 130mmHg; and 1159 patients (74%) with a blood pressure level greater than 130mmHg.

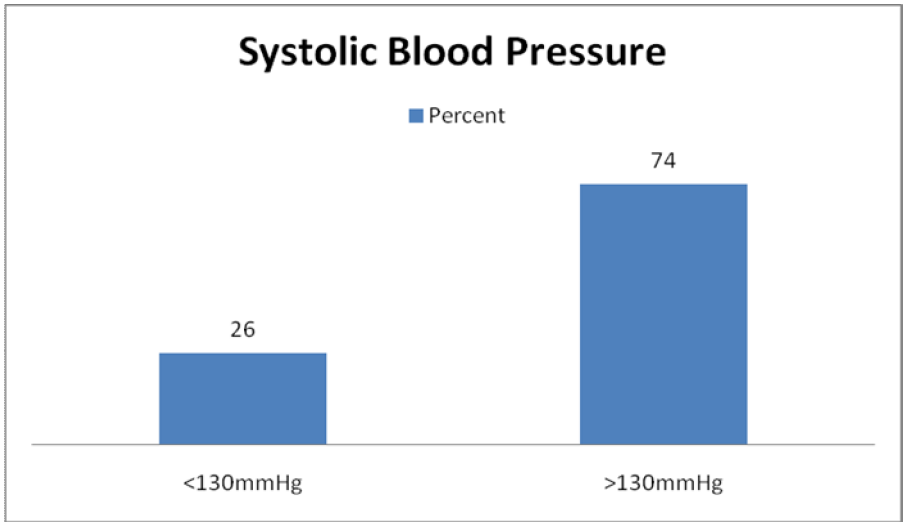

Figure 13

For diastolic blood pressure there was valid data for 83% of the patients. Of these, there were 717 patients (45%) with diastolic blood pressure less than the recommended 80mmHg; and 866 patients (55%) with a blood pressure level greater than 80mmHg.

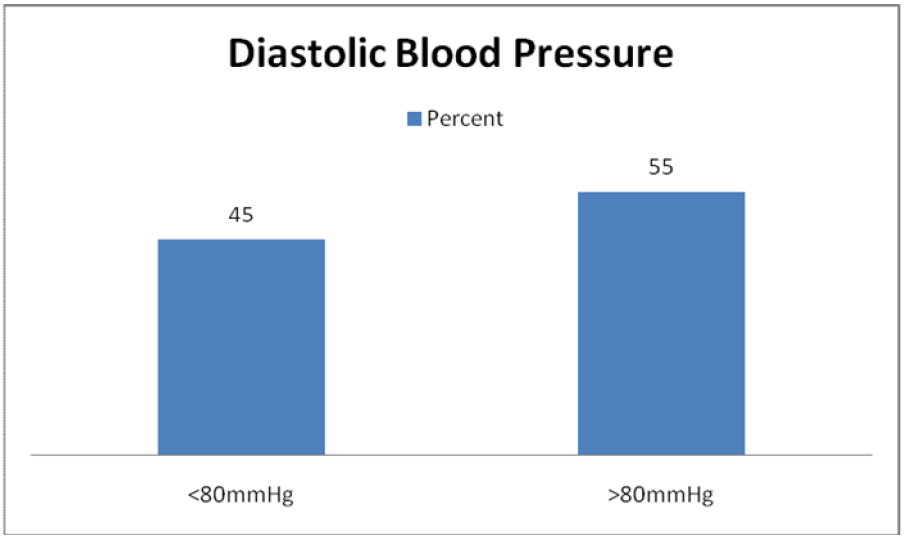

Figure 14

3.4.1.5 Smoking

Historically there has been no recommendation on how to record smoking in the consultation but since 2008 the user group has begun to recommend that smoking status is recorded in the patient consultation under the item cigarettes. It is saved automatically in this format as number of cigarettes when the smoking box is completed in the mediform. Lack of recommendation on the format is the main reason for the low recording of current smoking status seen in Table 7.

Table 8 Current smoking status recorded in consultations

Cigarettes	Frequency	Percent
Non-smoker	48	2
Smoker	50	3
Missing	1803	95

Smoking status is also recorded in the patient summary page under the item tobacco. The user group have recommended recording in this format for many years which explains why almost two thirds of patients have data recorded in this format as seen in Table 8.

Table 9 Smoking status recorded in patient summary

Tobacco	Frequency	Percent
Non-smoker	1006	53
Smoker	243	13
Missing	652	34

3.4.2 Inter-practice variation

3.4.2.1 HbA1c

Figure 11 shows that the rate of well controlled HbA1c (<6.5%) varies from 5% to 55% while the rate of poorly controlled HbA1c >7.5% varies from 16% to 66%.

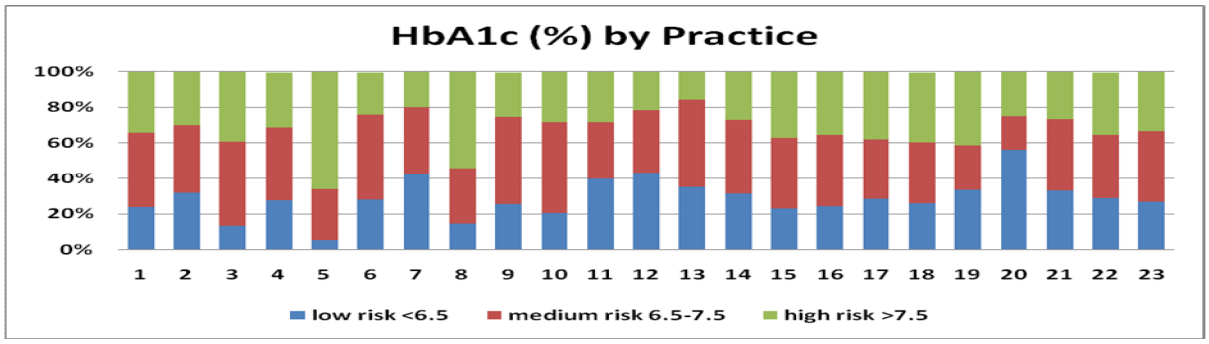

Figure 15

3.4.2.2 Lipid profile

From Figure 12 we can see that there is a less marked but still significant variation in cholesterol control. Well controlled cholsterol (<5mmol/l) varied from 57% to 85% while poorly controlled cholesterol (>6mmol/l) varied from 3% to 23%.

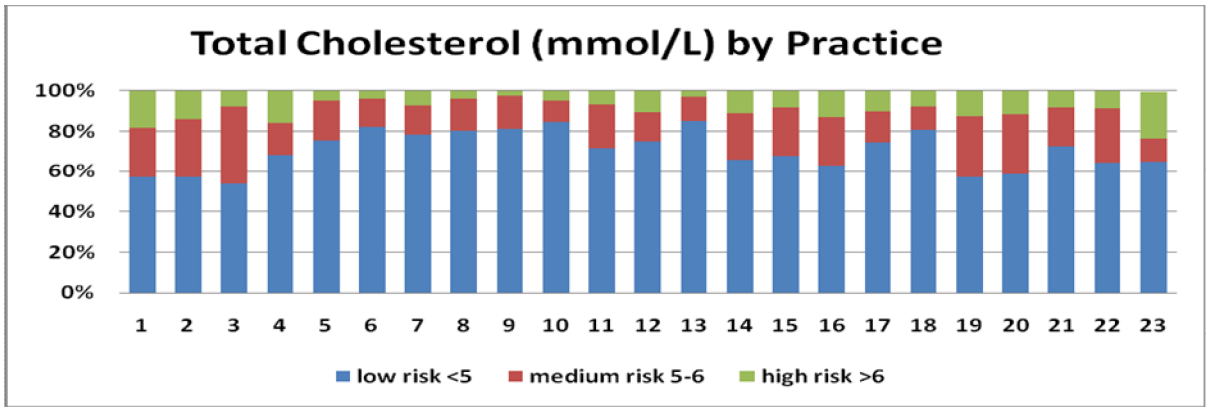

Figure 16

Not surprisingly Figure 13 shows that LDL control is similar to total cholesterol control. Well controlled LDL (<3mmol/l) varies from 47% to 88% while poorly controlled LDL varies from 2% to 34%.

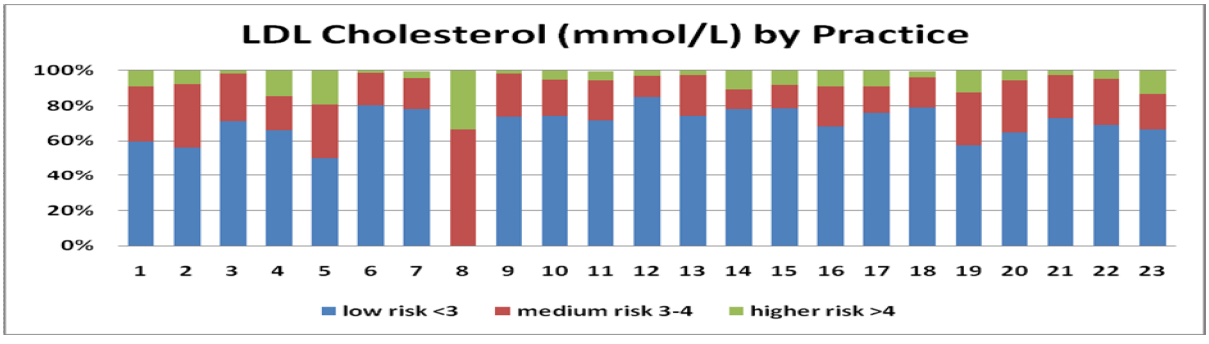

Figure 17

Figure 14 shows a similar pattern for triglycerides with well controlled (<1.7mmol/l) varying from 48% to 77% while poorly controlled (>2.2mmol/l) varied from 12% to 26%.

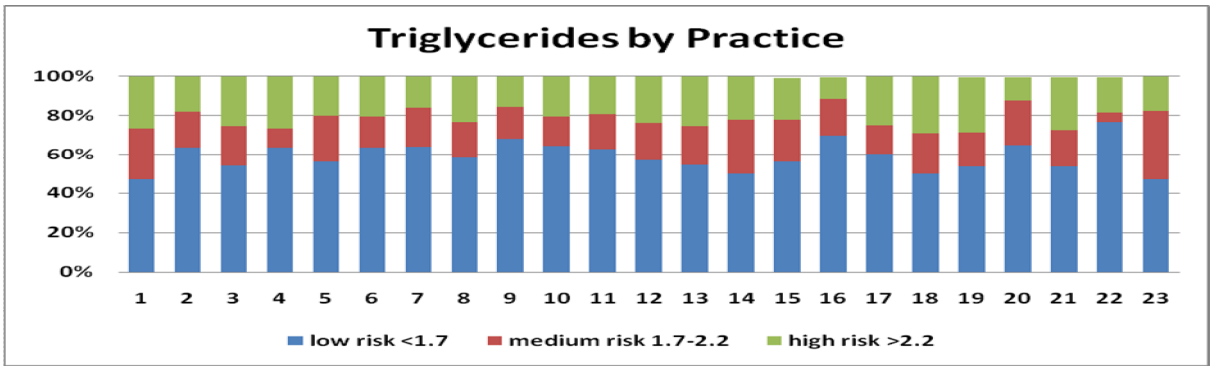

Figure 18

3.4.2.3 BMI

As BMI is rarely recorded in some practices it is difficult to make direct comparisons across all practices. It is clear from Figure 15 below that the full range of BMI values are prevalent in most practices and that almost all primary care staff are struggling against the obesity epidemic.

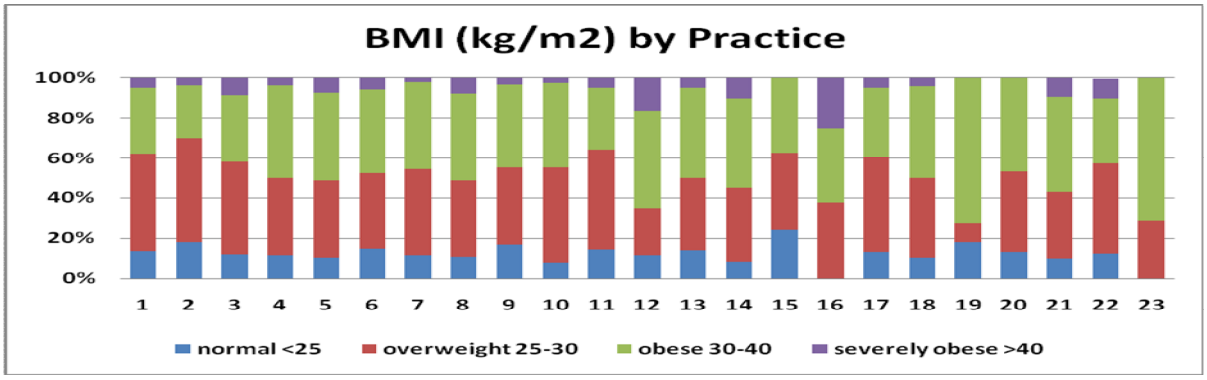

Figure 19

3.4.2.4 Blood Pressure

Figure 16 shows that the percentage with good blood pressure control (<130mmHg) varies from 7% to 52%.

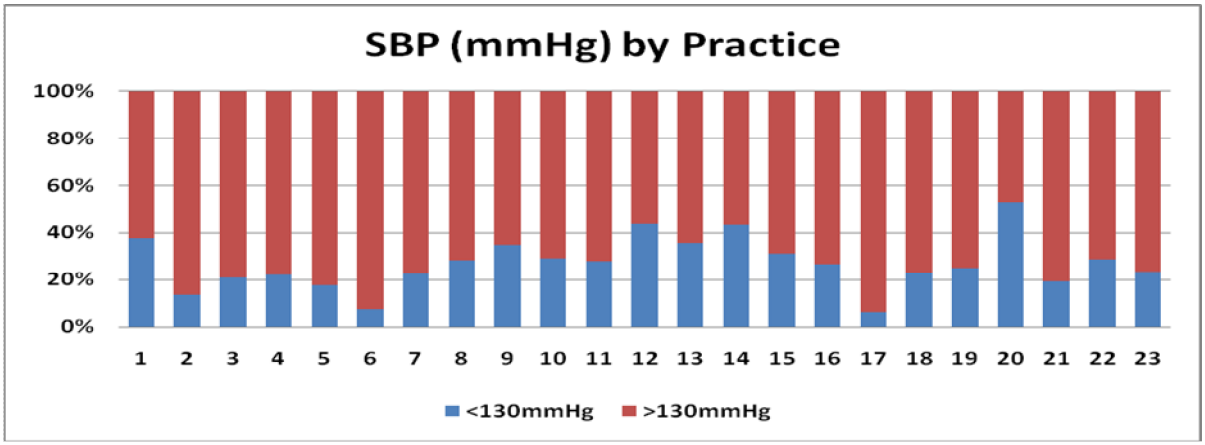

Figure 20

Ad with systolic blood pressure there is marked variation across practices with good control (<80mmHg) varying from 15% to 66%.

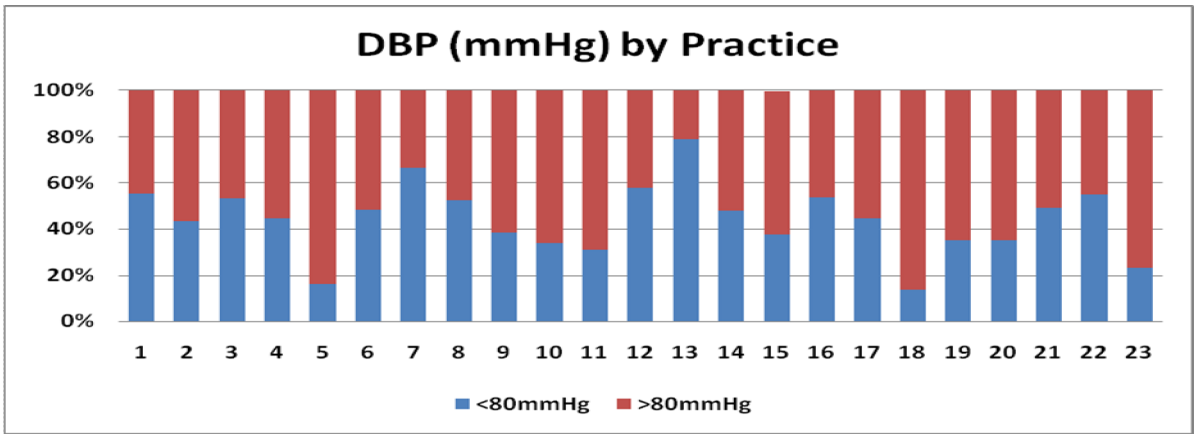

Figure 21

We did not do assess interpractice variations on smoking as we feel that much of the variation was due to different methods of recording this data and would not accurately reflect the clinical records of the practices.

3.4.3 Comparison with other studies

3.4.3.1 HbA1c

Comparing the HIUG audit with the DIG audit they are similar in terms of the percentage of patients with well controlled HbA1c (< 6.5%) HIUG=27% vs DIG=28%. However the HIUG group had significantly more patients with a poorly controlled HbA1c (>7.5%), HIUG 34% vs DIG 29%. Both HIUG and DIG have significantly better glycaemic control than the Midlands and UK audits.

Table 10 **HbA1c categories comparison with 3 other audits (Type 2 diabetes for Audit 2009 and DIG; Type 1 and Type 2 diabetes combined for the 2 remaining audit sites):**

HbA1c Categories	Audit '09	DIG Audit '08	Midlands Audit '03	England & Wales Audit '05-'06
	% (N)	% (N)	% (N)	%
low risk (<6.5%)	28 (438)	27 (200)	27 (240)	24
medium risk (6.5%-7.5%)	38 (599)	44 (323)	27 (245)	37
high risk (>7.5%)	34 (543)	29 (215)	46 (411)	40
Total	1580	738	896	-

3.4.3.2 Lipid profile

Comparing lipid control with the DIG audit shows that for total and LDL cholesterol the DIG audit is better while for Triglycerides the HIUG group is marginally better.

Table 11 **Lipid profile comparison with DIG audit (for Type 2 diabetes patients)**

Lipid Profile	Audit '09	DIG Audit '08

	% (N)	% (N)
Total Cholesterol mmol/L		
low risk <5	72 (1210)	79 (622)
medium risk 5-6	19 (320)	16 (128)
high risk >6	9 (142)	5 (42)
Total (% recorded)	88 (1672)	79 (792)
LDL Cholesterol mmol/L		
low risk <3	72 (964)	82 (534)
medium risk 3-4	22 (292)	16 (102)
higher risk >4	6 (83)	3 (22)
Total (% recorded)	70 (1339)	65 (658)
Triglycerides		
low risk <1.7	59 (987)	56 (359)
medium risk 1.7-2.2	19 (322)	19 (121)
high risk >2.2	22 (367)	26 (167)
Total (% recorded)	88 (1676)	64 (647)

3.4.2.3 BMI

Comparisons of BMI categories with the DIG group show an almost identical distribution of obesity

Table 12 BMI category comparison with DIG audit (Type 2 diabetes patients)

BMI Categories (kg/m2)	Audit '09	DIG Audit '08
	% (N)	% (N)
underweight <18.5	0.7 (8)	0.3 (1)
normal <25	12 (131)	11 (41)
overweight 25-30	40 (448)	37 (142)
obese 30-40	41 (449)	42 (162)
severely obese >40	6 (67)	9 (36)
Total (% recorded)	58 (1103)	38 (382)

3.4.3.4 Blood pressure

Table 13 Blood pressure categories comparison with DIG audit (Type 2 diabetes patients)

Blood Pressure (mmHg)	HIUG Audit '09	DIG Audit '08
	(%)N	% (N)
≤130/80	(31)493	34 (280)
>160/100	(10) 162	10 (78)
Total (% recorded)	(83) 1583	82 (821)

3.5 Age and Gender – Relationship to outcomes

A review of all outcome measures showed no variation based on gender. However some variations were noted when outcomes were compared across the 4 age groups chosen.

3.5.1 Age and HbA1c

A negative correlation was found between increasing age and HbA1c indicating that younger type 2 diabetics were prone to poorer glycaemic control.

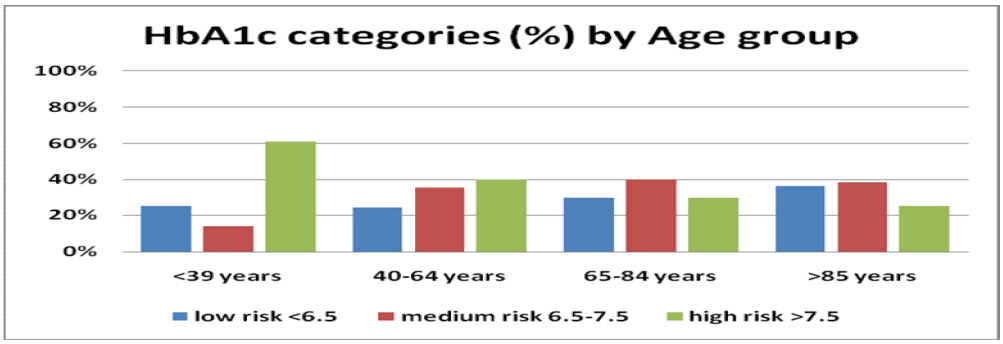

Figure 22

3.5.2Age and Lipid profile

As with HbA1c younger patients were found to have a lower percentage of patients reaching target for cholesterol, LDL and triglycerides

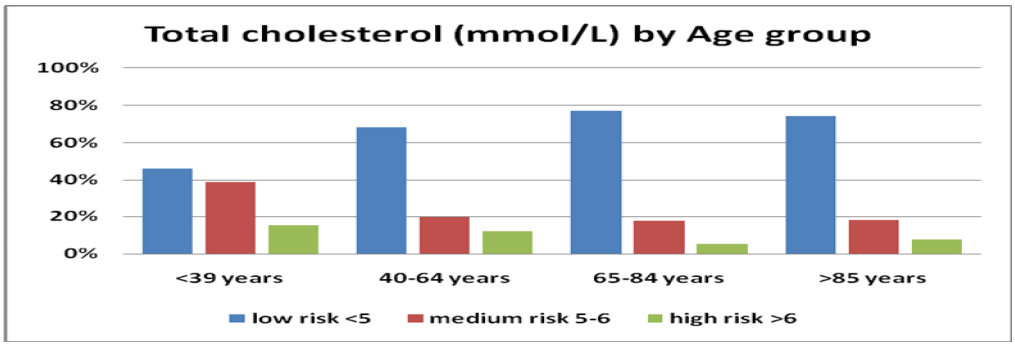

Figure 23

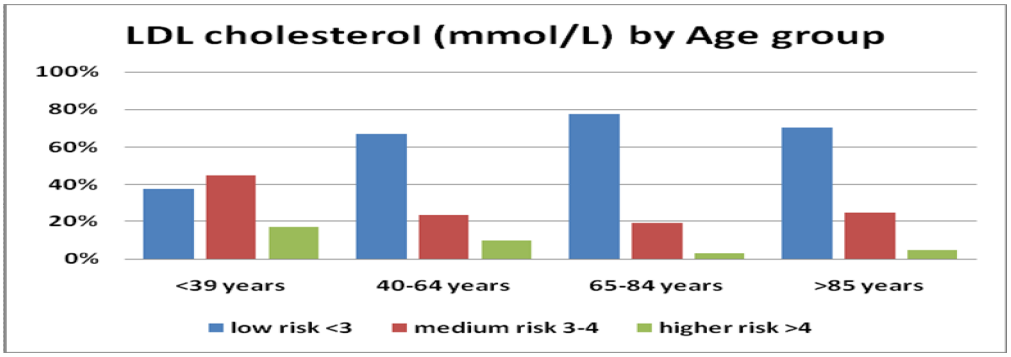

Figure 24

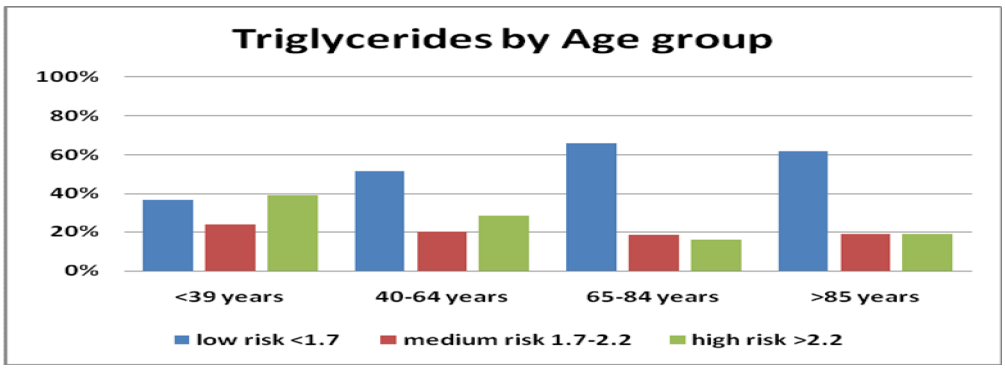

Figure 25

3.5.3 Age and BMI

Interestingly younger patients were also found to be much more likely to have a higher BMI ï whether this is the cause of their early onset or not it certainly emphasises the importance of weight loss particularly in this group.

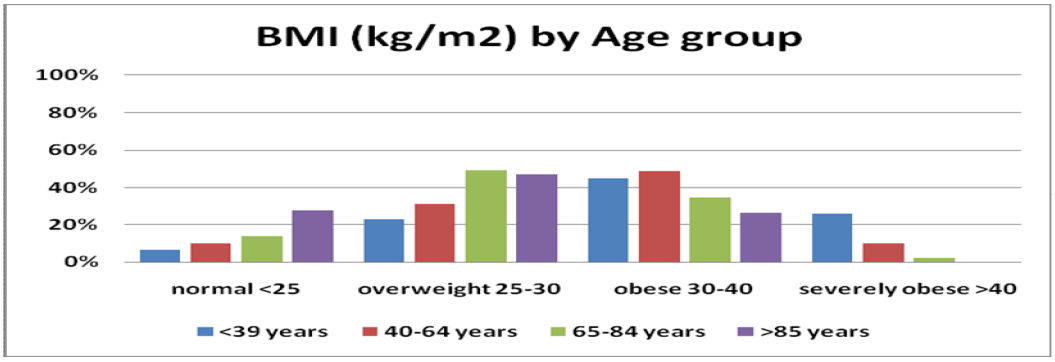

Figure 26

3.5.4 Age and Blood pressure

Not surprisingly unlike other outcomes younger patients are much more likely tio have a normal systolic blood pressure though diastolic pressure did not show and age relationship.

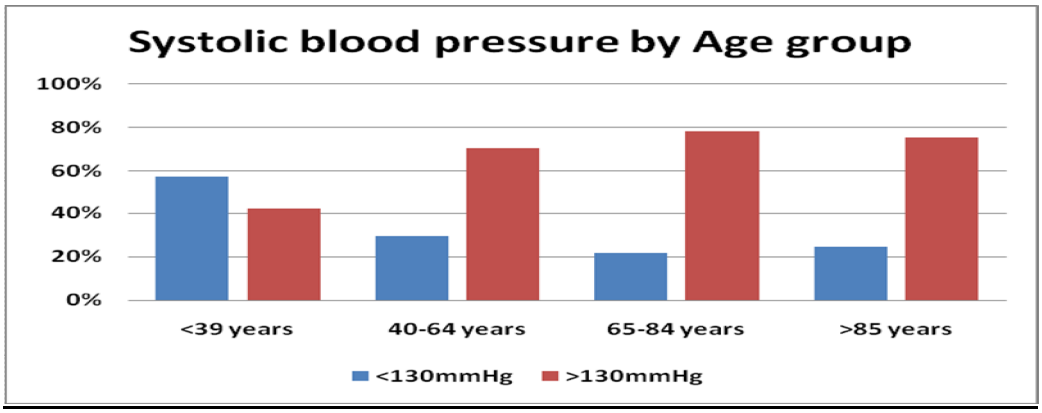

Figure 27

4 Discussion

Members of the Health Ireland Users Group (HIUG) have been working since 1996 to push the technology to the point where it is possible to provide practical, automated audit for users. As detailed in the background section there have been several attempts to achieve automated computerised audit since 1996 which have had only limited success due to a combination software problems and lack of incentives/resources. This audit is the culmination of these previous attempts and as can be seen from the results it stands with other primary care diabetic audits in terms of data quality and clinical relevance but is unique in Ireland in terms of the technology and the minimisation of workload for clinical staff. This has been happening in other countries for many years where incentives have been put in place to encourage the GPs and the software providers to develop the capacity for audit however it is a credit to the GPs involved that this has been achieved by HIUG without any resources or incentives.

From the perspective of diabetes audit in primary care in Ireland this adds to the information gathered from previous audits by the midlands and DIG groups. In addition it confirms that a group of GPs whose common thread is that they use the same software rather than a specific interest in diabetes can achieve a very high quality of diabetes care. It also defines the degree if inter-practice variation there is in terms of diabetes care. Potentially this provides a template for improving clinical care of chronic diseases through information technology and audit. We have gathered data on each practice and will look at how this relates to practice processes and outcomes to see if we can pinpoint areas for practice improvements but also areas which perhaps need to be tackled in the context of the national diabetes strategy.

The quality of the data extracted was very high however the excel files received did have to have some manual cleaning done to remove non numeric data from numeric fields. This occurred for a number of reasons as outlined in Section 3.1 and affected approximately 2% of the results(if we exclude BMI =0 and free text non numeric entries for Tobacco). We have solutions to the majority of these issues but these will require some technical changes on our part and some education for the users on how best to enter data to avoid these issues. The percentage of valid values recorded for each variable such as BP compares well with other audits and shows that the HIUG practices not only check and record these variables but they do so in a very consistent manner and that the analyses which we have designed are capable of extracting this data. The interpractice variation should provide us with an opportunity to identify issues creating difficulties with data extraction and this will be addressed through both technical changes and user group education meetings. We hope that the use of the mediforms will significantly improve the consistency of data entry.

The age and gender of the population is as expected with the increasing level of type 2 diabetes mellitus in an ageing population ï the breakdown is very similar to the DIG population. What is

most interesting is the variation in numbers of diabetics between practices and the workload implications that this entails. Other issues looking at workload will be investigated when we analyse the practice factors particularly in relation to whether the majority of diabetes care occurs in the practice or in secondary care and whether there are specific clinics and recall for diabetes care.

It is somewhat surprising that DIG should have a lower rate of vaccinations than other groups as it should be possible for computerised practices to more easily identify vaccine defaulters. There are a number of possible cause for this which we will review

- Poor recording of vaccinations (we feel this is unlikely as all practices have some vaccinations picked up)
- Poor awareness of need for vaccinations in diabetics
- Poor use of software for finding and recalling defaulters
- Practice factors such as staff shortages etc

In terms of diabetic outcomes the audit data compare well with the recent DIG audit and are significantly better than the older midlands and UK data. This is remarkable given that this group do not have a professed interest in diabetes but rather an interest in using information technology to improve practice management and patient care. It is all the more remarkable when you consider that there were no specific incentives or support given to this group to improve diabetic care ï the 3 other audit groups all have a diabetic interest and some form of incentives or support for diabetic care.

Interestingly the inter-practice variation is much more marked than the difference between the 4 different audit groups. To some degree this is predictable as the populations are smaller at practice level however it is hard to imagine that the only factor explaining the marked variations is statistical probability. To summarise the variation

- Well controlled HbA1c (<6.5%) varied from 5% to 55%
- Well controlled cholsterol (<5mmol/l) varied from 57% to 85%
- Well controlled LDL (<3mmol/l) varies from 47% to 88%
- Well controlled systolic BP (<130mmHg) varied from 7% to 52%
- Well controlled diastolic BP (<80mmHg) varied from 15% to 66%

We will be looking closely at the practice factors revealed in the practice questionnaires to see if there are any consistent reasons for such marked variation as well as asking the practices to

feedback to us their beliefs as to why their own practice varies from the average in different areas.

While doing the analyses we took the opportunity to look at whether there was any relationship between patient age or gender and their diabetic outcomes. We found no gender effects but some interesting relationships with age group. Younger patients fared worse in having a higher BMI, HbA1c, total and LDL cholesterol and triglycerides. This may reflect the fact that younger patients get diabetes because they have a higher BNI and that they just as they do not get the BMI down they are not adequately motivated or adherent to treatment to get the other risk factors under control. It may equally reflect the fact that health care workers do not treat these patients risk factors as aggressively as older patients partly because of their lower absolute risk but also perhaps because they feel that until the patient improves their BMI there is not much point in trying to manage other factors too aggressively. In any case this differential certainly merits more attention. Unsurprisingly older patients have higher systolic blood pressure as isolated systolic hypertension is a feature of advancing age and can be difficult to control without causing adverse effects.

5 Conclusions

Data can be collected using an automated system and for a limited number of the most relevant items and is of a quality comparable to manual data searches. This is remarkable given that there was no pre-defined dataset or data entry method or group of practices for audit. This is a testament to the GPs, their staff and the support and training provided by the Health Ireland Users Group. The ability of the Health One program to record data in a structured way and facilitate such complex audit with minimal workload for clinical staff is a strength that is well recognised by program users but poorly recognised elsewhere despite the strong allegiance of such a large group of GPs for over 18 years.

The HIUG group of practices compare very well with other primary care diabetes audits. This shows that practices with a broad interest in providing quality care and using a quality electronic health care record but with no co-ordinated special interest or support are providing diabetes care on a par with other diabetes groups in Ireland and the UK.

Inter-practice variation is a marked feature of the audit and will be addressed in the next project which is to compare the practice factors (questionnaires already returned by all 23 practices) with the process and outcome measures. The practice feedback reports highlight for each practice their strengths and weaknesses and provide guidance on how to tackle the weaker areas.

The lack of resources to support this audit has been a major obstacle to timely completion of the audit, report, practice feedback, practice training and further development of the mediforms and analyses.

Part of the reason for the high levels of process of care recorded was undoubtedly the semi-structured consultation for diabetes already provided by Health one for many years. Hopefully the new much improved structured record will further improve this but it requires some effort for practices to change their work practices and it behoves the HSE to support such change.

A single patient record for the primary care team would contribute to higher outcomes for process of care and hopefully for outcomes of care.

6 Future plans

- We will present this report to the participating practices, the Diabetes EAG, the HSE, other primary care diabetes initiatives etc
- Analyse the effect of practice factors on process and outcomes of diabetes care based on this audit and results of questionnaires already returned for all participating practices.
- Expand audit and mediform to include the minimum dataset agreed by the primary care diabetes initiatives.
- Re-audit in 2010 ï this will assess the impact of the changes in practices including updating their diabetes register, audit feedback and possible use of mediforms.
- Expand the audit to other HIUG practices
- Automate the process of data analysis and practice feedback
- Progress the mediform for asthma management in the context of the Asthma Society Project to include management protocol, patient self management printout and audit of process and outcomes
- Provide the platform for other audits to be undertaken on the HIUG database

Contact details for this report

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7 Appendices

DATA PROTECTION GUIDELINES

HEALTH ONE COMPUTER RESEARCH NETWORK

DATA PROTECTION ACT 1988:- (Greg Heylin 13/2/97)

1. **Personal Data**: means data relating to a living individual who can be identified either from the data or from the data in conjunction with other information in possession of the Data Controller.

2. A **Data Subject** is an individual who is the subject of personal data.

3. **Disclosure**: Includes the disclosure of information extracted from personal data and the transfer of data. A disclosure occurs whenever information extracted from the data is communicated to a third party either by word of mouth, in writing, by means of print out, or by displaying information on screen. If the identification of the data subject depends partly on the data and partly on other information in possession of the data controller, i.e. information in manual form, there will be no disclosure of the data unless the other information is also disclosed.

4. Data must not be used in such a way as damage or distress is, or is likely to be, caused to any data subject.

Where conditions may be identified with living subjects even without names and addresses; removal of names, addresses and date of birth may be necessary to anonymise data.

5. All data relating to individual patients will be strictly anonymised.

6. All participating GPs will be given a confidential identity number. We will not reveal any information relating to an individual GP to a third party with the GPs consent.

7. In accordance with section 2.5b all information will be used strictly for research purposes.

8. As those collecting the data we take responsibility for the future confidentiality and use of the data.

9. If electronic information transfer is undertaken we will ensure that the encryption standards used are adequate.

10. Postal transfers will be by registered mail. Patient access to the data is not necessary as we will ensure that all data is anonymised.

11. All participating practices will be asked to display a waiting room poster explaining to the patients the nature of the research network and anonymity/confidentiality of the data. They will also be encouraged to include this information in practice leaflets and to discuss it individually with patients.

COMPUTER RESEARCH NETWORK

THIS PRACTICE PARTICIPATES IN A COMPUTER RESEARCH NETWORK DESIGNED TO IMPROVE RESEARCH AND STANDARDS OF CARE IN GENERAL PRACTICE.

AS PART OF THIS NETWORK WE OCCASIONALLY EXTRACT INFORMATION FROM THE COMPUTER RELATING TO SPECIFIC DIAGNOSES, TREATMENTS, INVESTIGATIONS ETC.

WE WOULD LIKE TO REASSURE YOU THAT IN ACCORDANCE WITH THE DATA PROTECTION ACT

1) NO UNAUTHORISED PERSON CAN GAIN ACCESS TO THE DATA

2) ANY DATA THAT MIGHT IDENTIFY INDIVIDUAL PATIENTS IS NOT EXTRACTED FROM THE COMPUTER

3) ACCESS TO DATA IS ON A NEED TO KNOW BASIS ONLY

FINALLY WE ONCE AGAIN REASSURE PATIENTS THAT ALL INFORMATION IS ANONYMISED AND CONFIDENTIAL SO PLEASE DO NOT WITHHOLD INFORMATION FROM YOUR G.P. DUE TO FEAR OF LACK OF CONFIDENTIALITY.

This is a summary of my understanding of the current position of the 10 existing primary care initiatives in Ireland and the audit done in each.

1.Midlands Structured Diabetes Care Scheme

- Started 1998
- 2008-37 practices enrolled with almost 4,000 patients
- Annual Payment for 2 hrs PN time per pt. enrolled= 4 x thirty min visits
- 2 Diabetes Nurse Specialist=1.8wte based in Primary Care Unit.
- **Audit- Carried out by DNS Manually, Audit analysis by HSE Researcher, with individual GP Feedback**

2.South Inner City Partnership-Dublin

- Primary Care Diabetes Management element set up in 2000
- Currently 10 Practices Enrolled
- Community Nurse Specialist(.5wte) post holder left and has not been replaced, HSE Approved DNS Salary dispersed to 10 participating GPôs
- **Annual Audit**

3.Diabetes Interest Group (DIG) Cork

- Commenced in 2001
- Currently 28 practices. 3100 patients
- Diabetes Nurse Facilitator appointed in July 2007
- Plan to recruit Community DNS to team in 2009-3 years Pharmaceutical funding for same.
- **1,360 patients from 12 of the DIG practices have had their care audited in May 2008**

4.Sligo/Leitrim

- Commenced in 2001.
- 16 practices currently involved
- Two Diabetes Nurse Specialist work half time in the community and half time in Sligo General Hospital = 1WTE
- 6,000 patients are on the diabetes register. This register was compiled by a HSE appointee under the Cardiovascular Strategy and verified by GP surgeries diabetes registers.

5.East Coast Area Diabetes

- Commenced in 2002
- 10 Practices 560 patients enrolled.
- GP/PN Visits not funded -HSE Pay Locum GP for 1 study day
- Audit funded by HSE-GP ú10 per pt. audited
- Diabetes Nurse Specialist- based in Primary Care Unit 33.5hr/week (0.8wte)
- Service audited in 2005 and 2007

6.DIABETES WATCH

- Started in 2003
- 2008- 24 practices enrolled 1,400 patients
- HSE pay for 2 -3 Visits/yr, ú50 per visit
- Payment activated by receipt of completed Audit Sheet- 14 Variables
- Target based bonus payment system
- Audit is analysed by HSE Public Health Dept.
- Complete audit planned in 2009
- Advanced Nurse Practitioner in diabetes post accredited by National Nursing Council, post to be filled in next 6 months.

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7.GALWAY

- Diabetes Nurse Facilitator appointed in 2006 HSE Funded post.

8.Limerick/North Tipp/Clare

- Diabetes Steering Group established in January 2006
- 2007 Community Diabetes Care Facilitator- funded by the National Council for 2 years. Funding not renewed post vacant July 2009
- Diabetic Register - 9,000 patients now on diabetes register
- Interested GP Practices have been invited to set up diabetes clinics.
- **Audit of diabetes care is planned in 2009**
  .

9.DUBLIN

- Community DNS (1 wte) appointed Sept. 2007- employed by Beaumont Hospital
- DNS provides nurse led clinics for patients with Type 2 Diabetes in five primary care practices.
- **Audit of this service is planned**.

10.DONEGAL

- DNS, PCCC took up post in January 2009 (1 wte)
- 3 practices enrolled and diabetes clinic facilitated by DNS
- Funding for Long Term Conditions Management Programme was secured from MCNM for Donegal. Diabetes has been chosen as its first priority.

Clinical audit results are only available for

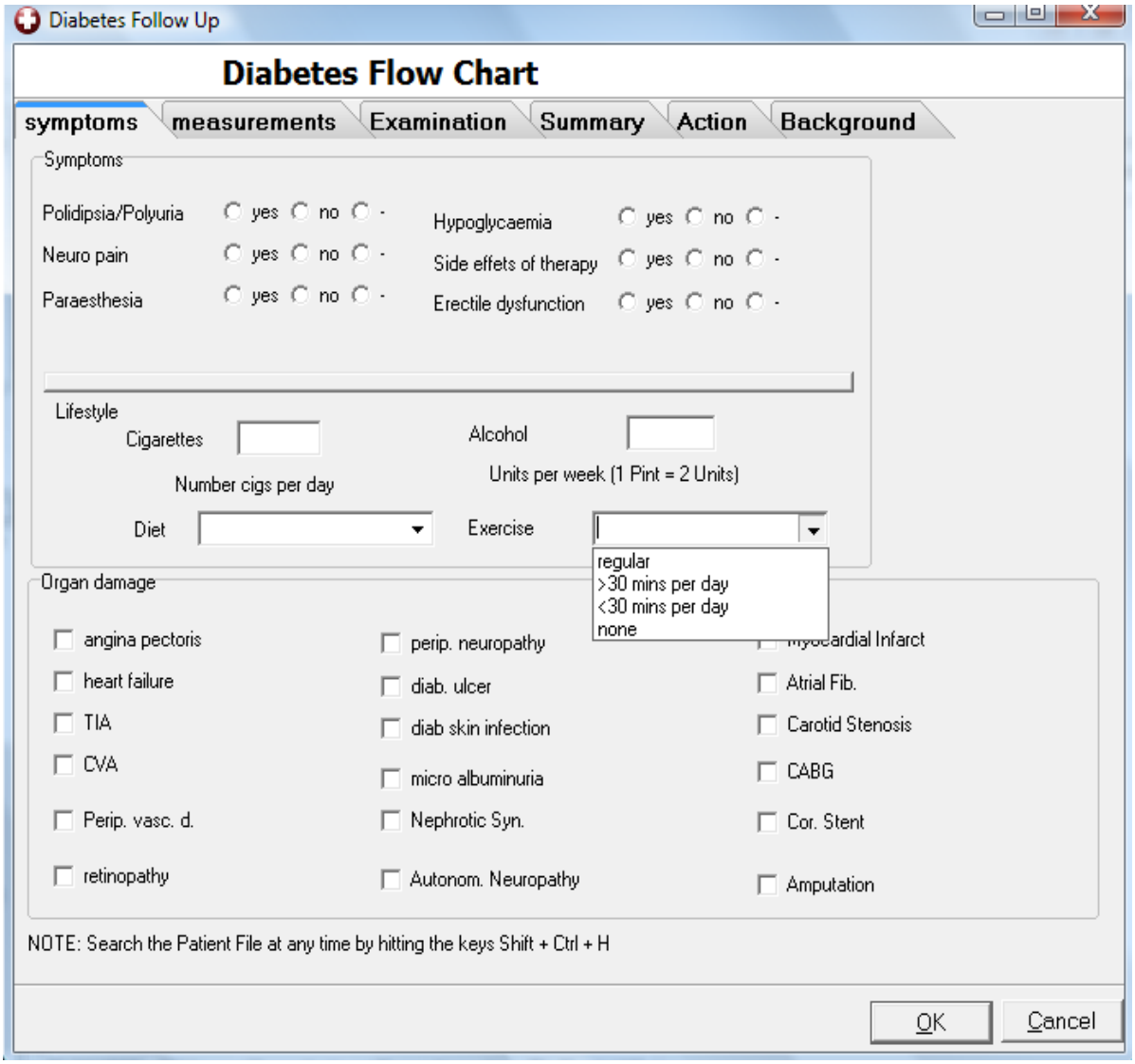
DIABETES MEDIFORM

PAGE 1 SYMPTOMS

The first box is symptoms which includes the 6 main diabetic symptoms as a reminder for staff. Ticking each item yes or no is a simple method of recording that these itmes have been assessed for audit purposes but is not compulsory

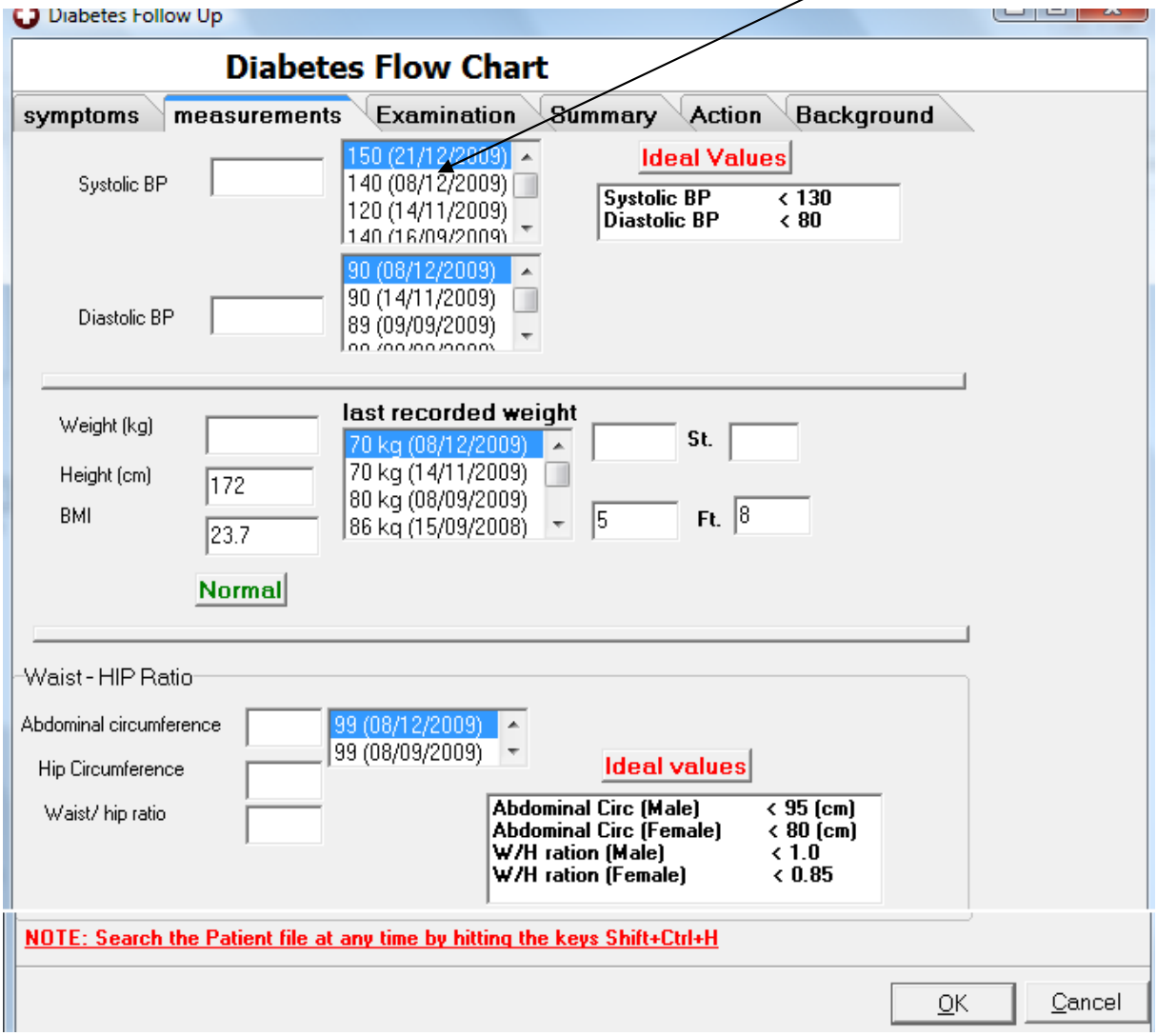
The second box is lifestyle and includes drop down lists for exercise and diet which can be altered by users as needed

The third box is diabetes complications and is mainly for audit purposes. It is possible to search the file for each possible complication anywhere in the patients file by using a simple Hot key function as shown below (Shift+Ctrl+H)



PAGE 2 MEASUREMENTS

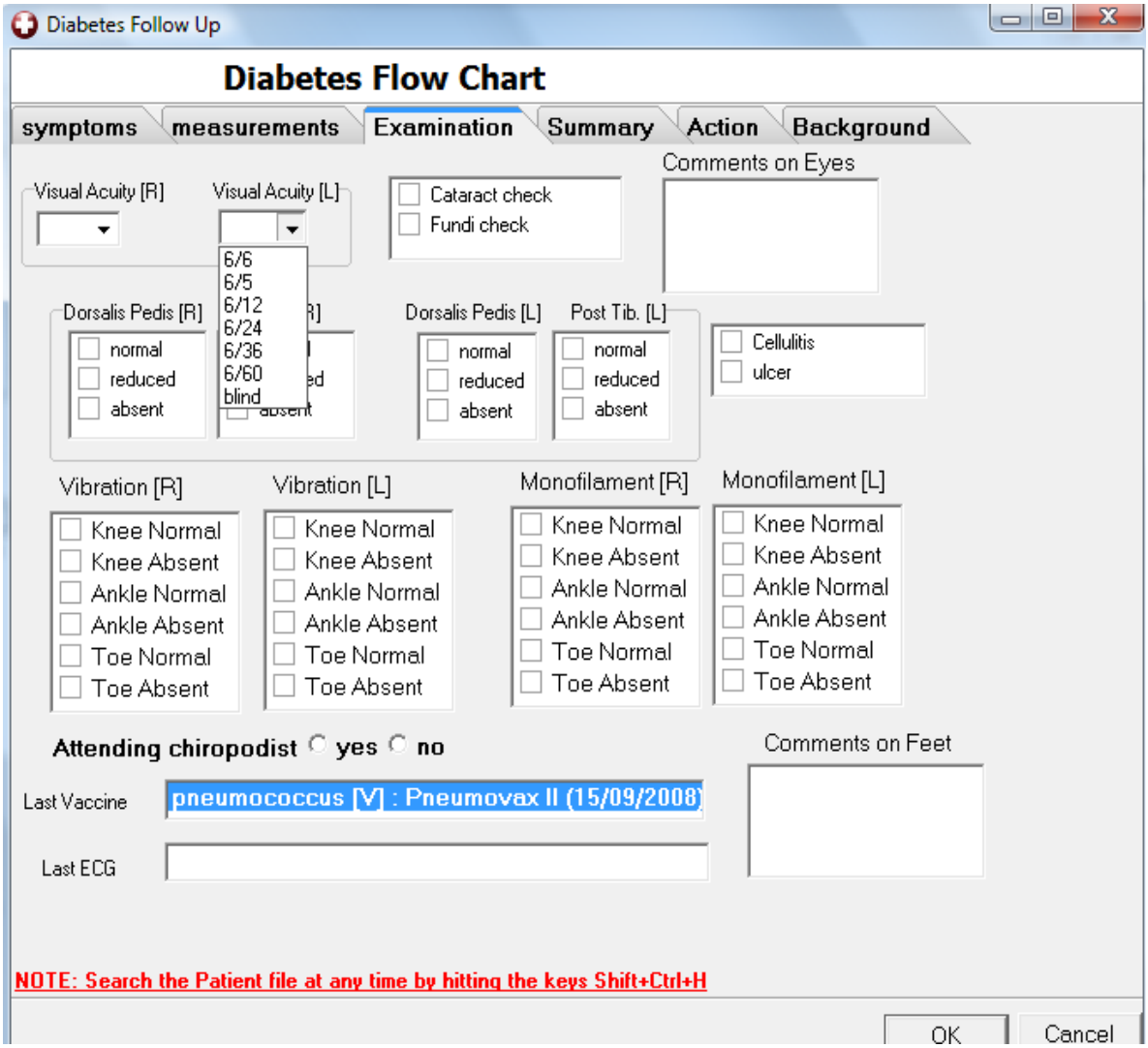
This page is where the patient measurements taken during the current consultation are entered. The ideal values for each item are also highlighted. In addition this page automatically pulls the previous values for each item such as blood pressure below – it is easy to scroll down through these lists to view all previous results.



PAGE 3 EXAMINATION

This page is where the annual foot and eye examinations are recorded. The tick boxes simplify data entry for audit purposes while the visual acuity is best corrected acuity and has a drop down menu. The free text boxes for eyes and feet allow for free text comments to ensure that the clinical context of skin and eye changes is not lost which would be a risk with tick boxes only.

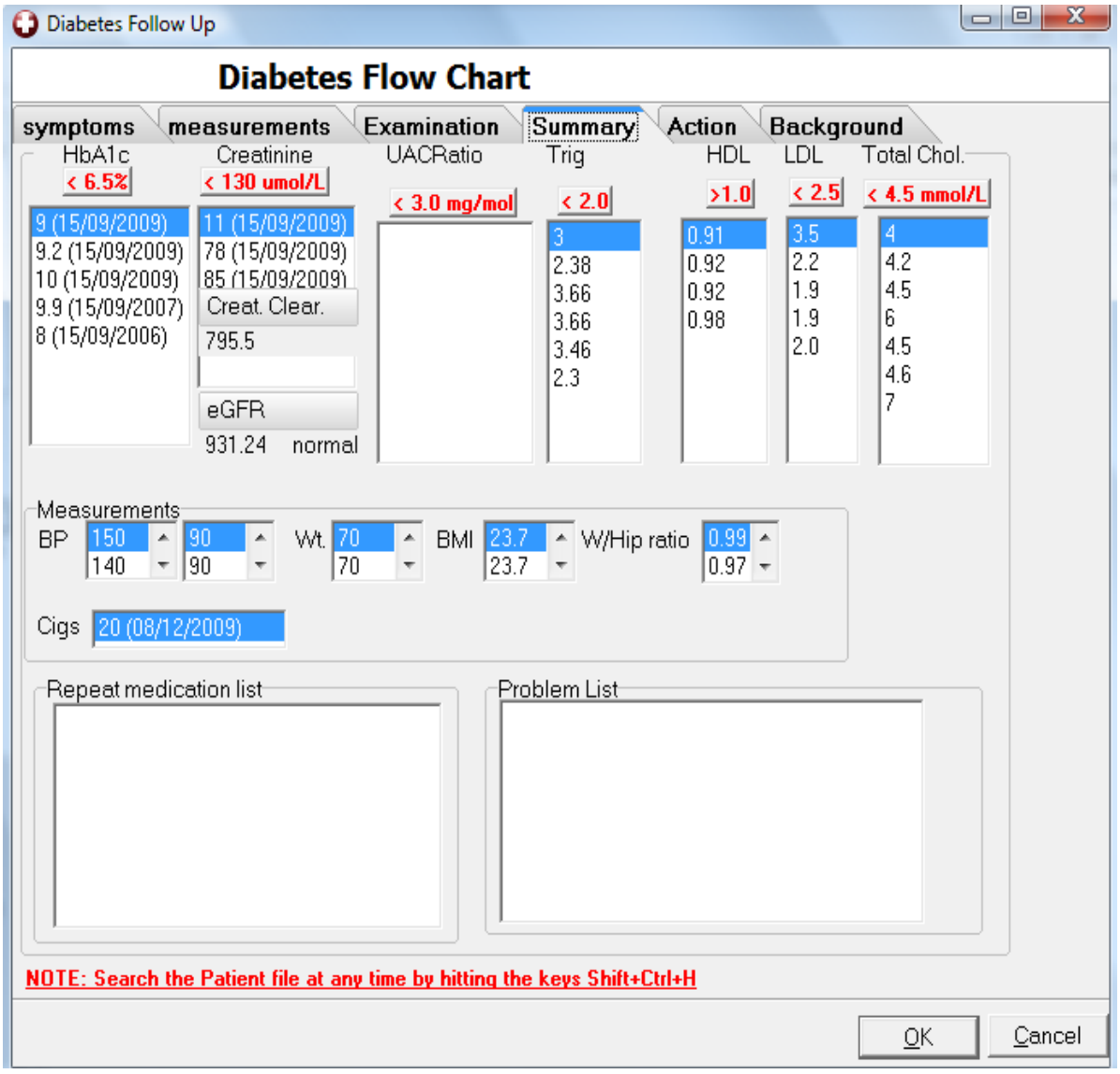
This patient also displays the vaccines received and last ECG as a reminder re possible overdue items.



PAGE 4 – SUMMARY

This is the critical page on the mediform which works like an automated flow sheet. The mediform extracts all the previous occurrences of each of the items so that you can easily see and show the patient how they are progressing with their management. To maximise impact for the patient the ideal value for each target is also displayed in RED at the top of each column.

This page also displays the patients current problem list and medication list which allows you to review all the possible management changes required while viewing one page.

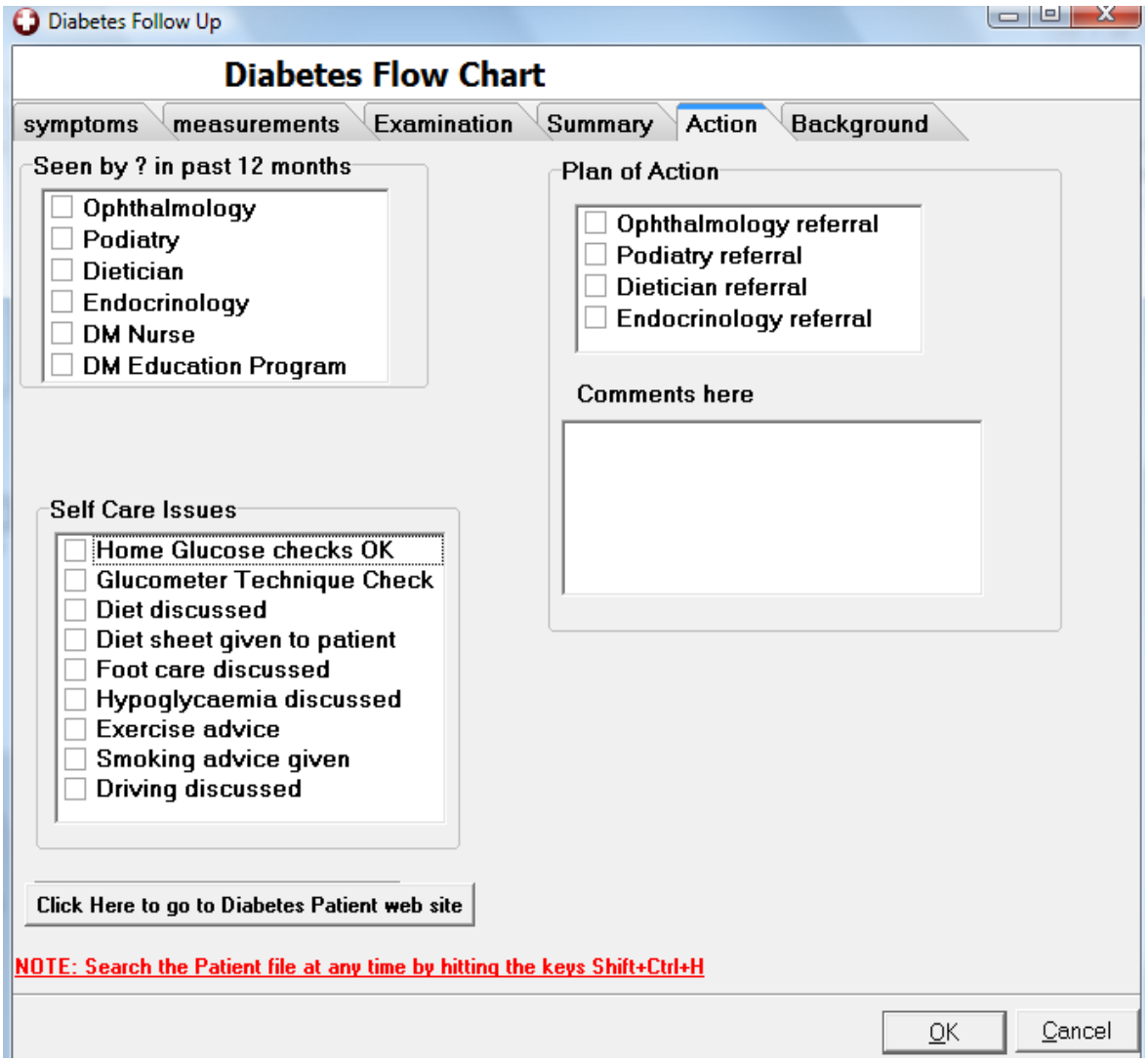


PAGE 5 PLAN OF ACTION

This page is where the patient management is recorded.

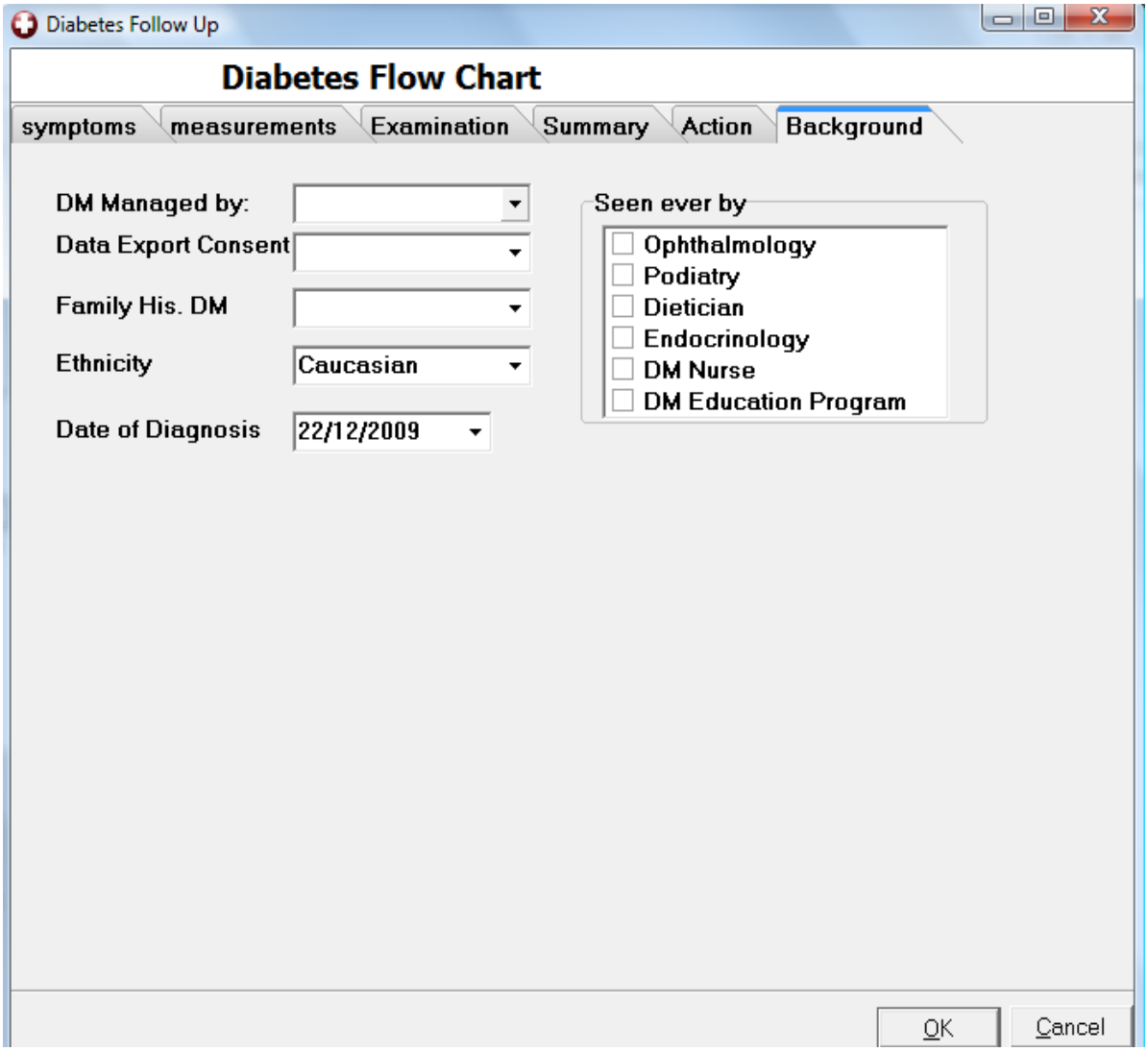
It is a combination of tick boxes for audit and free text for clinical comments

In addition there is a link to patient diabetes “patient information leaflets” website



PAGE 6 BACKGROUND

This page is not intended to be used for diabetic visits but rather as a reminder/defined manner to record items relating to the patients diabetes which are important for the purposes of audit.



NEXT MEDIFORM

Having used the mediform for over a year and getting feedback from audit participants a number of changes are to be made to the next version of mediform for 2010 including

Simplification to reduce from 6 to 4 pages of which the only the first 2 will be relevant to routine clinical management

Page 1 will include symptoms and measurements (target organ damage will be moved to last page)

Page 2 will include the summary page and the management page – we will also add an automated patient self management printout.

Page 3 will remain as is for now

Page 4 will have the target organ damage part added to it

TECHNICAL PROBLEMS AND SOLUTIONS

All practices have differences in the way their hardware and software is configured. This led to quite a number of problems which were difficult to resolve as the lead investigators live in the southwest and the participating practices are dispersed throughout the country. The following problems were encountered.

- Old version of Health One.
- Datawarehouse not active ï this is the background system for collating and storing the patient data in a format that is easily analysed thus allowing large and complex analyses to be done relatively quickly. It is possible to have this turned off which is useful if you have old slow computers but the majority of practices did not realise that theirs was turned off.
- Incorrect versions of the analyses or extraction formulae ï this occurred as these were being developed and fine tuned even as the audit was commencing. It is possible to avoid this by the user importing the latest template at the time of running the analysis (assuming that the practice is doing regular / automated web updates the most up to date version will already have been downloaded and importing will install it).
- Difficulties with importing analyses
- Problems with lab mapping to health one items ï as labs change their item names intermittently these items then no longer map to Health One items correctly. This was a problem for a few practices particularly in relation to HbA1c.
- Confusion re server and local machines in terms of software settings or patient file storage. Practices did not realise which machine they were downloading the analyses etc to or did not realise the patient data source they were running the analyses on. This manifested itself in relation to the
    - Datawarehouse
    - Analyses
    - Extraction formula

PARTICIPATING GENERAL PRACTITIONERS

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Cathy Foley	Clonmel, Co Tipperary
Colm Hackett	Clarecastle, Co Clare
Conor Oshea	Drogheda, Co Louth
Declan Murphy	Kilkenny City
Frank Hill	Cork City
Jack McCarthy	Ennis, Co Clare
Joe Clarke	Summerhill, Co Meath
John Delap	Coolock HC, Dublin 5
Kieran Murphy	Athea, Co Limerick
Linda King	Mulhuddart, Dublin 15
Ml Cleary	Ballyhaunis, Co Mayo
Michael Coleman	Tubercurry, Co Sligo
Michael Harty	Kilmihil, Co Clare
Michael Joyce	Blessington, Co Wicklow
Niall Maguire	Navan, Co Meath
Noelle Hewetson	Malahide, Co Dublin
Noreen Curtis Lineen	Achill, Co Mayo
Rory Odriscoll	Kenmare, Co Sligo
Truls Christiansen	Church Hill, Wicklow

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