Damm Sokkor!

Identifying, exploring and testing the factors influencing the care of patients with diabetes in primary care in Tunisia

Hugh Alberti

Volume 2:

Appendices

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List of appendices

Appendix 3.1: Semi-structured interview schedule

Can I first reassure you that you will remain completely anonymous and no record of the interview will be kept with your name on them.
Thank you for allowing me to record our conversation. The recording will also remain confidential.

The aim of my study is to discover more about the management of diabetes in Tunisia in primary care.

- What is your role in managing patients with diabetes? How long have you been involved in your role?

- What is your view of the management of diabetes in primary care in Tunisia?

- We know that all over the world, the care of people with diabetes is variable. What things do you think effect the care of people with diabetes in this country?

  Do you think that there any things that help produce good care of people with diabetes in this country?

  And any things that prevent good care?

- Things that have been looked at in other countries are to do with the patient, the health professional and the organisation of care. Apart from what we have already discussed,
  Do you think that there any things to do with the patient that might affect care of people with diabetes in Tunisia?

  Any things to do with the health professionals?

  Any things to do with the organisation of care?

- Is there any aspect of the management of people with diabetes that we have not discussed that you think is important.

- Other areas to ask about hypothesised during qualitative work:

Many thanks for your time. In the near future, I would like to discuss with you the summary I write of this interview to check that I have understood you correctly.

Appendix 3.2: Focus group interview schedule

"Thank you for your time. As … has just said, my name is Dr Hugh Alberti and I am a doctor from England. I am researching the care of people with diabetes in Tunisia. I have a few questions I would like to ask you if that is OK? You are free to go now if you would rather not, and you are free to leave at any time. Your responses will be anonymous; in particular, I will not tell anyone here from the centre what you have told me. As you can see I am recording our discussion but only myself and my research helper will listen to it. Is that OK?"

Introduction Question

What do you think about the management of patients with diabetes here?

Areas to bring up if not mentioned spontaneously:

- The medicines
- Herbal medicines
- Education
- Men vs. women
- Resources, cost.
- Cause of their diabetes.
- The centre and the facilities and waiting times
- The hospital: waiting times, staff and travelling there
- The doctors here
- The nurses here
- Any suggestions for improvement
- Anything to add

Appendix 3.3: Structured patient questionnaire

"Thank you for your time. As … has just said, my name is Dr Hugh Alberti and I am a doctor from England. I am researching the care of people with diabetes in Tunisia. I have a few questions I would like to ask you if that is OK? You are free to go now if you would rather not, and you are free to leave at any time. Your responses will be anonymous; in particular, I will not tell anyone here from the centre what you have told me. Is that OK?"

1. Introduction

Name or number / Age / Duration of diabetes / Family history of diabetes / Associated hypertension / Occupation / How far do you live from the centre?

2. Medication

Where do you consult for your diabetes care and how often? What medications do you take? Do you always take them? Are they available at the health centre? Do you feel that they are effective?

3. Herbal medicines

Do you or anyone in your family use herbal medicines? What do you use? How do you use it? How often do you use it? Do you take it with your prescribed medicines?

4. The centre

What do you think about the health centre? The facilities? The waiting times? The doctors? The nurses?

5. The hospitals

Do you ever attend any hospitals, for example, for an eye examination?
If yes, where did you go? What did you think of the hospital? The waiting times? The staff? Having to travel there?

6. Resources

How much do you pay to attend here? Is it hard to find the money?

7. Diet

Do you follow a diet for your diabetes? Who told you about it?

8. Gender

I have noticed that, like everywhere, more women than men attend this centre for diabetes care. Why do you think that is?

9. Suggestions

Do you have any ideas as to how care could be improved here at the centre?

10. Cause of their diabetes

What do you think caused your diabetes?

Extra

Do you have any thing else to say about diabetes care at this centre?

Appendix 3.4: Information sheet and consent form for semi-structured interviews

FICHE D'INFORMATION

Merci de nous accorder de votre temps et de consulter la présente fiche d'information.

Mon nom est Dr Hugh Alberti. Je conduis une étude sur la gestion du diabète dans les structures de soins de base en Tunisie. Je travaille conjointement avec la direction des Soins de Santé de Base de Tunis et l'Université de Newcastle en Angleterre.

L'autorisation de mener cette étude m'a été délivrée par le Ministère de la Santé Publique.

Quel est l'objet de l'étude ?
Le diabète est une maladie fréquente dans le monde et en Tunisie. L'actuelle étude se penche sur l'evaluation de la qualite des soins des patients atteints de diabète dans les centres de soins primaires en Tunisie. Son objectif est de mettre en evidence les eventuels facteurs qui pourraient influencer la qualité des soins offerts aux patients atteints de diabète dans ce pays.
On sait que la qualité de soins des personnes atteintes de diabète peut beaucoup varier d'un endroit à un autre. La présente étude est faite pour montrer pourquoi il en est ainsi et que peut on y faire dans un pays comme la Tunisie.

Que signifie la contribution à la présente étude ?
Je cherche à interviewer un grand nombre de personnes, aussi bien du domaine de la santé que des patients, qui sont concernées par le soin des diabétiques en Tunisie.

PARTICIPER A LA PRESENTE ETUDE IMPLIQUE :
1. Un interview que je conduirai moi-même, dont la durée sera de 20-30 minutes, et qui sera enregistrée.
2. Je vous donnerai également plus tard le temps de discuter l'interview pour voir s'il existe des points que vous n'approuvez pas ou que vous souhaiteriez aborder.

Qu'en serait-il si vous décidez de ne pas participer à l'interview, ou bien d'abandonner une fois commencée ?
Vous êtes libre de refuser d'être interviewer et libre de vous retirer de l'interview à tout moment.

Qu'en est-il de la confidentialité ?
L'interview restera strictement confidentiel et ne sera rendu accessible qu'aux membres du groupe de recherche. Des extraits de l'interview pourraient constituer une partie du rapport final de l'étude, mais ni votre nom, ni un quelconque élément vous identifiant ne feront en aucun cas partie, dudit rapport.

Coordonnées du chercheur :
N° tel : 71 692 355 ; 22 659 476
Adresse: BP 66.2073 Borj Louzir Ariana, E-mail: hugh.alberti@ncl.ac.uk

FORMULAIRE DE CONSENTEMENT

- Je confirme avoir lu et compris la fiche d'information
- Je confirme avoir eu, à ma satisfaction une explication du contenu de l'étude et avoir eu l'occasion de poser des questions.
- Je connais la personne à contacter au cas où j'aurais ultérieurement des questions à poser.
- Je suis informé du fait que mon interview, aussi bien l'enregistrement que la copie transcrite, serait gardée confidentielle.
- Je suis entièrement d'accord que des extraits anonymes de mon interview soient utilisés aux fins de la publication de la recherche.
- J'adhère entièrement à ladite étude.

Nom du participant : .....

Signature du participant : .....

Date : .....

Nom du chercheur : .....

Signature du chercheur : .....

Date : .....

Appendix 4.1: Annual regional report form

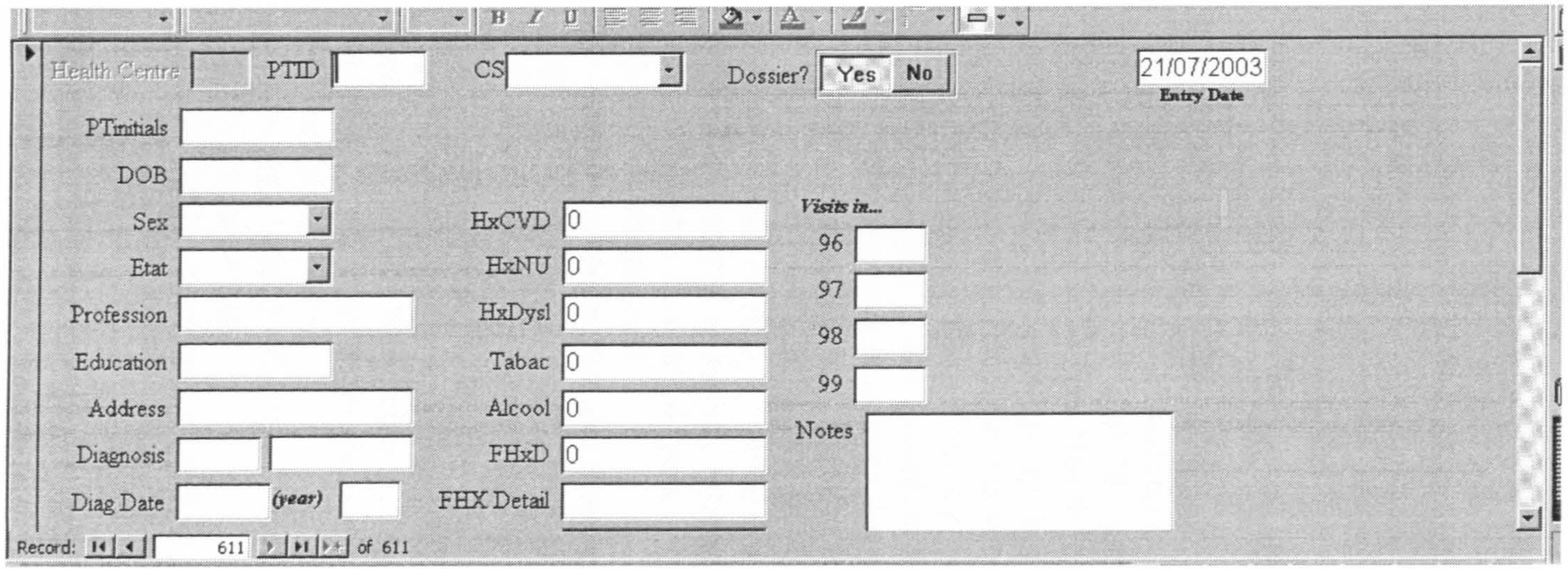
CSB..... **CIRCONSCRIPTION.....**

MODELE DU RAPPORT ANNUEL

PROGRAMME NATIONAL DE PRISE EN CHARGE DES DIABETIQUES ET DES HYPERTENDUS

	NOMBRE
Nombre total de consultants (nouveaux consultants de l'année en cours)	
Nombre total de malades suivis au centre : - Diabétiques seulement ---------- - Hypertendus seulement ---------- - Hypertendus et Diabétiques associés ----------	
Nombre de malades Hypertendus et Diabétiques suivis en ambulatoire (dans les structures hospitalières et recevant leur traitement dans le CSB) : - HTA : ---------- - Diabète : ---------- -HTA+ Diabète : --------	
Nombre total de cas nouvellement dépistés de l'année : - Diabétiques seulement ---------- - Hypertendus seulement ---------- - Hypertendus et Diabétiques en même temps ----------	
Nombre total de cas nouvellement dépistés au stade de complications : - rénales ---------- - rétinopathie hypertensive et/ou diabétique ---------- - cardiovasclulaires ---------- - neurologiques ----------	
Nombre total des CSB	
Nombre total des CSB ayant une consultation pour les chroniques	
Médecins formés 2000 en : - Diabète ---------- - HTA ----------	
Nombre total des médecins généralistes de santé publique : ----------	
Nombre de Glucomètres fonctionnels : ----------	
Nombre de boites de bandelettes utilisées : ----------	
Nombre de supervisions réalisées: - ----------	

Appendix 4.2: The purpose-designed Microsoft Access database used for the medical record review data collection



Appendix 4.3: Data collected from the patient records into the database

Level 1: Patient data

- Patient number: This was an original 5-digit number. The first 2 digits indicated the health centre. The last three digits specified the patient based on their number in the disease register or the number assigned them for randomisation purposes.
- Date of entry of data collection.
- Patient's initials: Collected as a reliability check if the record was reviewed a second time.
- New record: Yes/no if a new medical record had been used at anytime
- Date of birth: If only the year was known, they would be assigned 1st January and it was noted in the "Notes" section that only the year was known.
- Sex: Male/female
- Civil state: Married, divorced, widow/widower, single, other
- Profession: Entered as recorded
- Education level – according to the national definitions:
  0 – illiterate
  1 – attended primary school (up to the age of around 12 years)
  2 – attended secondary school (up to the age of around 18 years)
  3 – continued education after 18 years of age
- Health Insurance coverage: Health insurance coverage was used as a marker of poverty. It includes many groups but the majority of patients are:

a) "Type 1 Indigent": The patient is very poor and receives full free health cover.
b) "Type 2 Indigent": The patient is poor and receives partial health cover.
c) "CNSS"/"CNRPS": The patient, or more often their employer or ex-employer, pays health insurance premiums that provides the patient partial health cover.
d) "Payant": The patient has no health insurance coverage and must pay full charges. In practice, few patients pay the full charge.

- Address: Town or village entered only
- Diagnosis: Entered as recorded (usually D, HD, NIDDM, IDDM, etc.)
- Diagnosis Date: As entered (year only)
- Height (in centimetres)
- Past history of cardiovascular disease: Yes/no
- Past history of renal disease: Yes/no
- Past history of lipid disorder: Yes/no
- Family history of diabetes: Yes/no
- Family history details: Relationship to the person with diabetes (to verify that family history was based on a first degree relative)
- Smoking habit: Yes/no (no space allotment in medical records for ex-smokers)
- Alcohol habit: Yes/no
- Visit counts 1996, 1997, 1998, 1999: Manual count of visit entries for chronic disease management
- Notes: Comments entered regarding any unusual data or any interesting or relevant remarks written in the patient record

Level 2: Consultation Data (for all visits made from 1st January 2000 onwards)

- Patient number: as above
- Visit number: Automated digit
- Consultation date
- Glucose result[i]

- Creatinine result[i]
- Cholesterol result[i]
- HbA1c result
- Urine examination performed: Yes/no
- Eye examination performed: Yes/no
- Eye examination result: Details of findings
- ECG examination performed: Yes/no
- ECG result: Details of findings
- Weight: In kilograms
- Blood pressure: In mmHg
- Cardiovascular examination performed[ii]: Yes/no
- Cardiovascular examination result: Details of findings
- Foot examination performed[ii]: Yes/no
- Foot examination result: Details of findings
- Rendez-vous: Date of next appointment. If a time period was indicated, the next appointment date was calculated manually.
- Medication changed: Based on the list of prescribed medications for this consultation compared to the previous one: Yes/No
- Observance (Compliance to medication): Yes/No
- New record used: Yes/no if the details of this consultation were taken from a new disease-specific medical record

Level 3: Medication data

- Visit number: As above
- Medication: Name of all medications prescribed as treatment for diabetes, hypertension and hypercholesterolaemia. If no medications were prescribed for diabetes, "Diet only" was entered.
- Medication change: Each medication was categorised as increased, reduced, started, stopped, continued or unknown

Additional comments

- If any data were illegible I requested help from the clinician or other staff at the centre.
- If two values were entered for one visit, such as blood pressure, the lower value was used as it was hypothesised that the patient was requested to rest for some time and the measurement repeated. The exception to this was if intra-muscular lasilix (frusemide) was given to the patient; in that case it was presumed that the lower result was following the injection and thus the higher result was entered.
- On a regular basis, the database would be searched for any aberrant data. Any obviously misplaced data would be re-located or removed.

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[i] Values were recorded in medical records as either mmol/l or g/l; it was decided that all values should be in mmol/l. For ease of data entry, if a glucose value of less than 4 was entered the database was programmed to automatically multiply the number by 5.5 to convert the value to mmol/l. If, in fact, the value was less than 4 but the unit was mmol/l, or more than 4 but the unit was g/l, a manual calculation was performed. Likewise, creatinine values of less than 50 were automatically multiplied by 8.84 and cholesterol values of less than 3 were automatically multiplied by 2.59 to convert them to mmol/l. Manual calculations were performed for values outside of this range

[ii] Any indication of an examination performed (such as RAS – no abnormality detected) was taken as an affirmative.

QUESTIONNAIRE D'EVALUATION

DU PROGRAMME NATIONAL DE PRISE EN CHARGE DES DIABETIQUES ET DES HYPERTENDUS DANS LES STRUCTURES DE 1ÈRE LIGNE

Organisation du travail dans le CSB

1- Existe- t-il un médecin responsable du PN HTA/ DIABETE dans le CSB ?

Oui ☐ Non ☐

2- Existe t-il une consultation hebdomadaire pour les chroniques dans votre centre ? :

Oui ☐ Non ☐

3- Existe t-il une diététicienne le jour de consultation des chroniques dans votre centre ? :

Oui ☐ Non ☐

4- Existe t-il un programme de formation du personnel para médical dans votre centre ? :

Oui ☐ Non ☐

5- Pratiquez-vous des séances d'éducation pour les patients ? :

Oui ☐ Non ☐

6- Si Oui, à quel rythme ? :

1/semaine ☐

1/ 15 jours ☐

1/ mois ☐

Autre ☐

7- Quel type d'éducation ? :

Individuelle ☐ de groupe ☐ Autre ☐

8- Utilisez-vous les supports éducationnels fournis par la DSSB ? :

Oui ☐ Non ☐

9- Par qui est faite l'éducation des patients dans le centre ? :

Médecin ☐ diéteticienne ☐ Agent paramedical ☐ Autre ☐

10- Les dossiers médicaux spécifiques à la prise en charge des chroniques sont-ils utilisés par tous les médecins ? :

Oui ☐ Non ☐

11- Les carnets de suivi des chroniques sont-ils livrés à tous les malades ? :

Oui ☐ Non ☐

Si non , pourquoi ? .....

12- Le registre des chroniques est-il à jour et bien rempli ? :

Oui ☐ Non ☐

si oui, par qui ? .....

13- Existe t-il un glucomètre dans votre CSB ? :

Oui ☐ Non ☐

14- Les bandelettes réactives sont-elles disponibles ? :

Oui ☐ Non ☐

Si non, quel est le % d'utilisation / an ? .....

15- Utilisez-vous le glucomètre pour :

- Le dépistage du Diabète ☐
- Le suivi du Diabète ☐
- Autre : .....

16- Existe t-il dans votre centre ? :

- Un pèse personne : Oui ☐ Non ☐
- Un appareil à tension : Oui ☐ Non ☐
- une toise Oui ☐ Non ☐
- un mètre ruban Oui ☐ Non ☐

17- Existe t-il dans votre centre les affiches et les supports éducatifs sur le Diabète et l'HTA ? :

Oui ☐ Non ☐

si non, pourquoi ? .....

18- Nombre de médecins dans le centre ayant pratiqué un stage de formation sur :

- Le Diabète : .....
- L'HTA : .....

19- Quels sont les problèmes rencontrés dans votre centres ? - Quelles sont vos suggestions pour une meilleure prise en charge des malades chroniques ?

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Merci

Appendix 4.5: Regional deprivation scores

A regional deprivation score was calculated using the United Nations regional poverty indicators in the 2004 National Report on the Millennium Development Goals.[247] The score was based on the following variables used by the United Nations:

v1	Rural population with no access to drinking water – 2002
v2	Population with no access to tap water – 2002
v3	Population with no access to sanitation network – 2002
v4	Population with no access to electricity – 2002
v5	Households using paraffin as a source of energy – 1999
v6	Households with no kitchen – 1999
v7	Households with no toilets – 1999
v8	Households with no bathrooms – 1999
v9	Households with no car – 1999
v10	Households with no TV – 1999
v11	Households with no fridge – 1999
v12	Dropout rate at preparatory level (%)
v13	Dropout rate at primary level (%)
v14	Rate of illiteracy
v15	Illiterate active population
v16	Illiteracy rate in women
v17	Women without secondary education level
v18	Women without higher education level
v19	Inactivity rate of women 30 – 34 age group
v20	Level of women's unemployment
v21	Home births – 2001
v22	Unvaccinated infants aged between 24 to 35 months

The actual values (percentages) are listed in Table 3.4. To give each indicator equal weighting, a score was calculated for each indicator with the highest value of any region given a score of 1 for each indicator. A sum of scores was then calculated for each region (maximum 22) – see Table 3.5. These scores were used in the multivariate analysis.

Table 3.4 Regional Deprivation Indicators – values (all percentages)

Governorate	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	v11	v12	v13	v14	v15	v16	v17	v18	v19	v20	v21	v22
Tunis	0	1.6	3.7	0.7	0.7	3.7	0.9	43	71.6	4.6	9.3	9	0.8	15.8	6.7	22.5	63.7	91.3	56.6	18.5	0	19.1
Ariana	0.5	2.8	28.6	1	0.8	3.3	1.4	62.3	75.1	6.6	16.2	7.9	0	19.7	12.5	26.5	70.9	93.5	68.7	12.5	1.2	25
Ben Arous	0.3	2.3	24	1.3	0.6	3.3	1.8	50.5	74.9	5.7	11.6	9.9	0.4	16.1	6.9	22.5	64.4	93.8	64	22.2	0	15.5
Manouba	1.3	7.4	37.5	1.6	0.8	3.3	1.4	62.3	75.1	6.6	16.2	6	0	19.7	12.5	30.3	70.9	93.5	68.7	12.5	1.2	25
Nabeul	4.8	20.2	17	1.1	0.9	49	4.2	66.3	82.7	8.1	19.3	9.7	1.3	23.3	16.3	47.7	75.1	96.7	65	10.6	1.2	5.2
Zaghouan	3.9	42.3	13.3	4.2	0.7	16.9	17.4	88.7	89.3	24.7	52.8	10.5	2.1	36.3	22.8	35.1	81.5	98.5	79.9	30.3	0	7.7
Bizerte	9.4	27.5	14	2.4	1.7	13.3	11.4	78.9	88.8	15.2	34.1	11.1	1.1	27.2	16.3	46.2	76	97.3	68.7	17.6	3.7	23.2
Béja	19.7	41.1	5	7	2.2	17.4	16.8	84.2	89.4	17.5	43.8	8.9	2.1	35.6	29.1	53.3	78.7	97.6	70.4	22.7	4.8	7.2
Jendouba	22.4	53.6	20.5	7.1	1.4	19.1	26.8	88.5	93.2	24.6	48.4	7.7	2.5	40.1	38.2	43.2	84	98.1	73.5	14.5	15.2	14.8
Le Kef	13.5	43.4	16.5	9.1	6.8	13.1	16.2	89.8	89.1	17.8	44.2	8	3.1	31.8	20.7	48.1	79.1	98	77.9	32.6	13.7	13.7
Siliana	16.7	52.1	14.7	12.7	3.8	22.6	31.6	90.2	90	29	59.5	8.3	3.2	37	27.7	55.2	82.6	97.8	76.8	32.5	28.7	14.7
Kairouan	13.7	48.7	17.8	10.6	1.2	22.7	33.9	86.8	89.3	28.8	65.3	13	4	44.3	40.5	56.7	87	98.4	74.2	14.5	21.7	18.5
Kasserine	11	54.5	45	16.3	2.2	31.1	52.8	92.2	94.1	49	80	10.2	3	44	37.3	51.2	85.5	98.5	85.4	29.3	51.3	20.6
Sidi Bouzid	13	62.2	59	10.3	0.5	18.5	59.3	94.9	89.1	38.4	71.3	9.4	2.6	38.5	33.4	31.2	85.1	98.5	82.8	8.6	33.7	19.2
Sousse	0.1	5.8	14.4	1.9	0.4	6.9	5.1	52.1	81.6	8.4	21.8	9.4	0.7	22.4	12.6	26.3	72.9	94.6	59.1	14	0	15.4
Monastir	0	1.1	32	1.4	0.2	3.6	1.1	48.4	82.2	6.5	12.7	8.4	0.8	18.8	7.4	44	69.9	94.9	58.9	7.8	0	14.8
Mahdia	10.7	28.4	56.5	4.5	0.3	9.8	11	78.7	86.1	13.1	38.1	10.9	2.3	32.4	31.5	31.9	84.2	98.3	62.1	7.1	3.5	13.4
Sfax	6.2	24	50.5	1.3	0.8	4.3	8.5	62.8	77.3	11.4	23.8	8.7	1.7	22.1	14.7	32.8	75.3	95.7	65.2	15.4	0.8	18.6
Gafsa	2.2	20.2	51.9	3.9	1.4	14	17.6	78.2	90.2	15.3	30.9	6.9	1.8	24.1	17.9	34.3	73.5	97.1	73.9	27.6	18.7	15
Tozeur	0.1	2.4	21.8	1.2	0.1	9.5	4	80.8	93	9	19.1	7.6	1.7	23	14.8	32.4	76.3	97.8	72.1	29.9	9.3	22.4
Kebili	1.5	6.9	73.2	0.3	0.1	3.4	3.2	69.9	86.9	7.7	22.4	8.2	2.1	22.9	18.4	31.1	74.1	97.8	84.8	21.4	13.3	15.3
Gabès	0.6	16.5	45	4.3	0.2	11	12.2	68.3	84.8	14.9	30.2	5.8	1.1	25.4	19.9	34.1	76.8	97.6	75.6	12.5	1.1	14.2
Medenine	1.3	27.1	90	2.8	3	5.2	5.2	63.5	78.3	14.3	32	9.4	1	24.9	16.1	33.6	78.4	98.3	87.2	16.2	18.4	9.7
Tataouine	1.5	23.9	69	5	0.3	3.2	9.1	72	68.1	16.3	32.3	5.9	1.2	25.8	21.1	35.2	80.9	98.7	82.8	16	22.8	28

Table 3.5 Regional Deprivation Indicators – scores

Governorate	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	v11	v12	v13	v14	v15	v16	v17	v18	v19	v20	v21	v22	**Total**
Tunis	0.00	0.02	0.04	0.04	0.10	0.08	0.02	0.45	0.76	0.09	0.12	0.69	0.20	0.36	0.17	0.40	0.73	0.93	0.65	0.57	0.00	0.68	**7.09**
Ariana	0.02	0.04	0.32	0.06	0.12	0.07	0.02	0.66	0.80	0.13	0.20	0.61	0.00	0.44	0.31	0.47	0.81	0.95	0.79	0.38	0.02	0.89	**8.12**
Ben Arous	0.01	0.03	0.27	0.08	0.09	0.07	0.03	0.53	0.80	0.12	0.15	0.76	0.10	0.36	0.17	0.40	0.74	0.95	0.73	0.68	0.00	0.55	**7.62**
Manouba	0.06	0.11	0.42	0.10	0.12	0.07	0.02	0.66	0.80	0.13	0.20	0.46	0.00	0.44	0.31	0.53	0.81	0.95	0.79	0.38	0.02	0.89	**8.28**
Nabeul	0.21	0.31	0.19	0.07	0.13	1.00	0.07	0.70	0.88	0.17	0.24	0.75	0.33	0.53	0.40	0.84	0.86	0.98	0.75	0.33	0.02	0.19	**9.93**
Zaghouan	0.17	0.64	0.15	0.26	0.10	0.34	0.29	0.93	0.95	0.50	0.66	0.81	0.53	0.82	0.56	0.62	0.94	1.00	0.92	0.93	0.00	0.28	**12.40**
Bizerte	0.42	0.42	0.16	0.15	0.25	0.27	0.19	0.83	0.94	0.31	0.43	0.85	0.28	0.61	0.40	0.81	0.87	0.99	0.79	0.54	0.07	0.83	**11.41**
Béja	0.88	0.62	0.06	0.43	0.32	0.36	0.28	0.89	0.95	0.36	0.55	0.68	0.53	0.80	0.72	0.94	0.90	0.99	0.81	0.70	0.09	0.26	**13.11**
Jendouba	1.00	0.81	0.23	0.44	0.21	0.39	0.45	0.93	0.99	0.50	0.61	0.59	0.63	0.91	0.94	0.76	0.97	0.99	0.84	0.44	0.30	0.53	**14.45**
Le Kef	0.60	0.66	0.18	0.56	1.00	0.27	0.27	0.95	0.95	0.36	0.55	0.62	0.78	0.72	0.51	0.85	0.91	0.99	0.89	1.00	0.27	0.49	**14.37**
Siliana	0.75	0.79	0.16	0.78	0.56	0.46	0.53	0.95	0.96	0.59	0.74	0.64	0.80	0.84	0.68	0.97	0.95	0.99	0.88	1.00	0.56	0.53	**16.10**
Kairouan	0.61	0.74	0.20	0.65	0.18	0.46	0.57	0.91	0.95	0.59	0.82	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85	0.44	0.42	0.66	**16.05**
Kasserine	0.49	0.82	0.50	1.00	0.32	0.63	0.89	0.97	1.00	1.00	1.00	0.78	0.75	0.99	0.92	0.90	0.98	1.00	0.98	0.90	1.00	0.74	**18.58**
Sidi Bouzid	0.58	0.94	0.66	0.63	0.07	0.38	1.00	1.00	0.95	0.78	0.89	0.72	0.65	0.87	0.82	0.55	0.98	1.00	0.95	0.26	0.66	0.69	**16.03**
Sousse	0.00	0.09	0.16	0.12	0.06	0.14	0.09	0.55	0.87	0.17	0.27	0.72	0.18	0.51	0.31	0.46	0.84	0.96	0.68	0.43	0.00	0.55	**8.15**
Monastir	0.00	0.02	0.36	0.09	0.03	0.07	0.02	0.51	0.87	0.13	0.16	0.65	0.20	0.42	0.18	0.78	0.80	0.96	0.68	0.24	0.00	0.53	**7.69**
Mahdia	0.48	0.43	0.63	0.28	0.04	0.20	0.19	0.83	0.91	0.27	0.48	0.84	0.58	0.73	0.78	0.56	0.97	1.00	0.71	0.22	0.07	0.48	**11.65**
Sfax	0.28	0.36	0.56	0.08	0.12	0.09	0.14	0.66	0.82	0.23	0.30	0.67	0.43	0.50	0.36	0.58	0.87	0.97	0.75	0.47	0.02	0.66	**9.91**
Gafsa	0.10	0.31	0.58	0.24	0.21	0.29	0.30	0.82	0.96	0.31	0.39	0.53	0.45	0.54	0.44	0.60	0.84	0.98	0.85	0.85	0.36	0.54	**11.48**
Tozeur	0.00	0.04	0.24	0.07	0.01	0.19	0.07	0.85	0.99	0.18	0.24	0.58	0.43	0.52	0.37	0.57	0.88	0.99	0.83	0.92	0.18	0.80	**9.95**
Kebili	0.07	0.10	0.81	0.02	0.01	0.07	0.05	0.74	0.92	0.16	0.28	0.63	0.53	0.52	0.45	0.55	0.85	0.99	0.97	0.66	0.26	0.55	**10.19**
Gabès	0.03	0.25	0.50	0.26	0.03	0.22	0.21	0.72	0.90	0.30	0.38	0.45	0.28	0.57	0.49	0.60	0.88	0.99	0.87	0.38	0.02	0.51	**9.84**
Medenine	0.06	0.41	1.00	0.17	0.44	0.11	0.09	0.67	0.83	0.29	0.40	0.72	0.25	0.56	0.40	0.59	0.90	1.00	1.00	0.50	0.36	0.35	**11.09**
Tataouine	0.07	0.36	0.77	0.31	0.04	0.07	0.15	0.76	0.72	0.33	0.40	0.45	0.30	0.58	0.52	0.62	0.93	1.00	0.95	0.49	0.44	1.00	**11.28**

Appendix 5.1: Health centre photographs

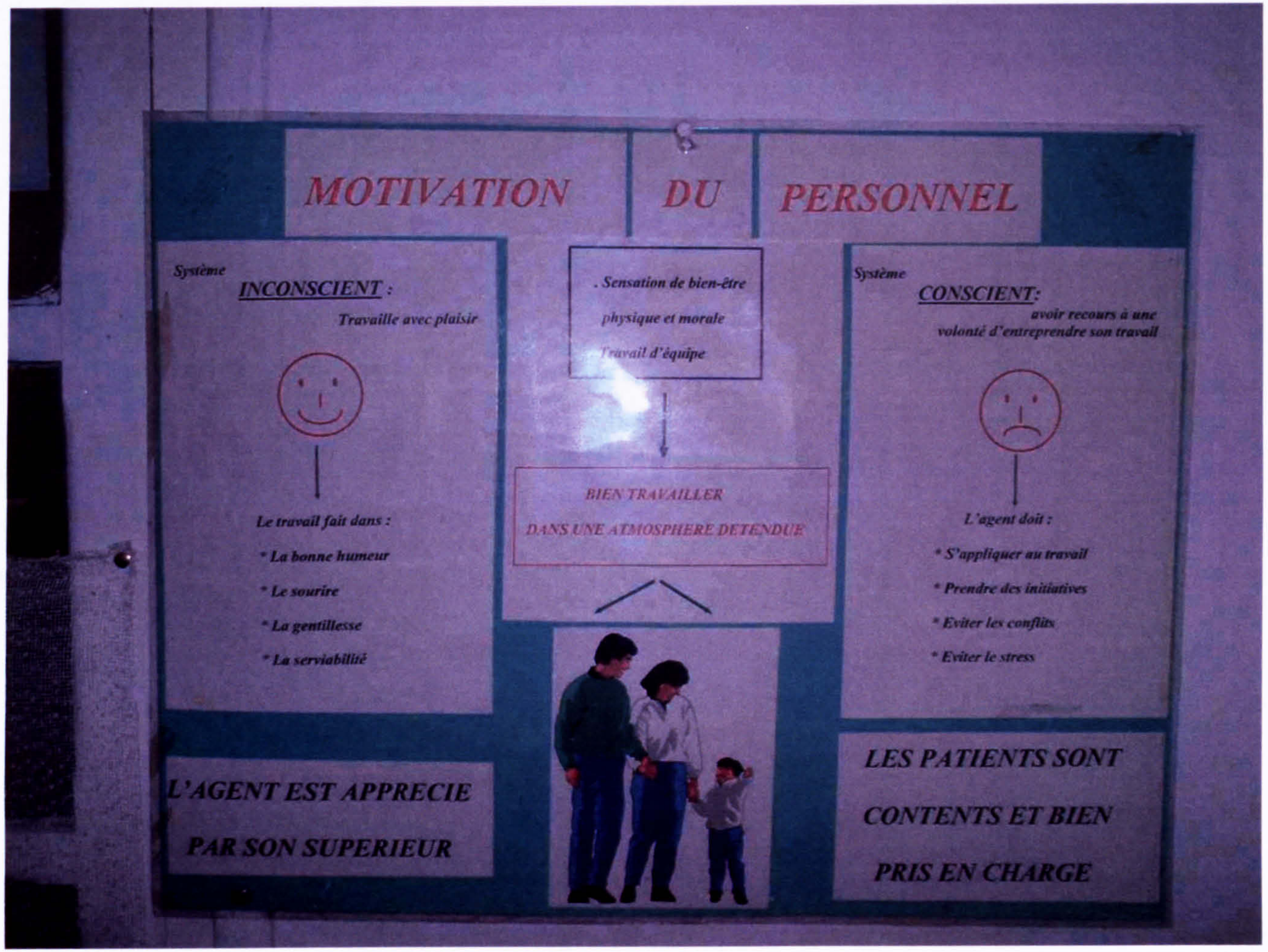
1. A typical health centre

2. Centre A

3. *Centre B*

4. *Centre C*

Appendix 5.2: Poster of 'motivation' seen at centre A



Appendix 6.1: Extract of data (transcript) and collaborative ethnographic analysis from patient focus group 2, centre A.

Extract of transcript

(Interviewer in italics)

And tell me about the medicines ...

Pt5: ... I always take the medicines

Always, always (voices)

Pt5: And if I go somewhere, I take the medicines with me.

And are there always medicines available here at the centre?

Yes, yes (voices)

Pt5: If you finish your medicines you come here and if they don't have any you buy it from the pharmacy (said positively as if this was no problem)

And I've heard that some Tunisians use traditional medicines, like herbs...

Pt5: Yes, its true. Lots use traditional medicines...

Yes, yes (voices)

Are there traditional medicines for diabetes?

Pt5: Yes, yes, there is medicines for diabetes – always hamdullah here, I take everything and always its fine.

So do you all use traditional medicines?

Pt2: No, no, I just use medicines from here...

(Agreement generally)

Pt5: I use a little "lubeen", I drink it in water.

Pt4: Yes, that's good

Is this for hypertension or for diabetes?

Pt5: Diabetes

And its good?

Pt5: Good, it doesn't have bad effects and doesn't give me "gas"...

And do you always use it or just when...

Pt5: Just when I feel unwell I take it, just sometimes, not every day...

Ethnographic analysis

Preliminary list of domains:

From first researcher (author)

1. TYPES OF ILLNESSES PATIENTS HAVE
2. CHARACTERSITICS OF DIABETES/Level of diabetes or sugar
3. LENGTH OF TIME WITH DIABETES
4. LEVELS OF BLOOD PRESSURE
5. LEVELS OF WEIGHT
6. RESULTS OF STRESS
7. "HERE" (THE CENTER)/What patients do "here" (at the health centre)
8. WHAT PATIENTS DO AT THE HOSPITAL
9. CHARACTERISTICS OF "HERE"/Positive aspects of the Centre
10. PROBLEMS WITH THE HOSPITALS
11. WHAT DOCTORS DO AT THE CENTRE
12. PATIENT CONTRADICTIONS
13. WHEN YOU MUST PAY/Things that cost money
14. RESULTS OF HAVING NO MONEY
15. RHETORICAL QUESTIONS, MOSTLY ABOUT MONEY
16. MEDICINE
17. CONTRAST OF PAST TO PRESENT
18. WHAT WE NEED HERE
19. "WOMEN HAVE ALL THE PROBLEMS"
20. TYPES OF TRADITIONAL MEDICINE
21. CHARACTERISTICS OF "LUBEEN"
22. ORIGINS OF DIABETES/Causes
23. VIEWS ON DIET FOR DIABETES

From second researcher (BA)

1. CHARACTERSITICS OF DIABETES
2. ORIGINS OF DIABETES
3. EFFECTS ON HYPERTENSION
4. "HERE" (THE CENTER)
5. CHARACTERISTICS OF "HERE"
6. MEDICINE
7. TYPES OF PEOPLE "HERE"
8. PLACES
9. PATIENTS
10. TYPES OF TRADITIONAL MEDICINE
11. CHARACTERISTICS OF "LUBEEN"
12. WHAT DOCTORS DO
13. MOBILE PHONE
14. WHEN YOU MUST PAY
15. "THE HOSPITALS ARE …"
16. "WOMEN HAVE ALL THE PROBLEMS"
17. "WAY IN THE PAST"
18. WHAT WE NEED HERE

Final agreed list of domains:

Illnesses

1. TYPES OF ILLNESSES PATIENTS HAVE
2. CHARACTERSITICS OF DIABETES/Level of diabetes or sugar
3. LEVELS OF BLOOD PRESSURE
4. EFFECTS ON HYPERTENSION
5. RESULTS OF STRESS

Places

6. PLACES
7. "HERE" (THE CENTER)/What patients do "here" (at the health centre)
8. WHAT PATIENTS DO AT THE HOSPITAL

9. CHARACTERISTICS OF "HERE"/Positive aspects of the Centre
10. PROBLEMS WITH THE HOSPITALS

People

11. TYPES OF PEOPLE "HERE"
12. WHAT DOCTORS DO AT THE CENTRE
13. PATIENT CONTRADICTIONS

Money

14. WHEN YOU MUST PAY/Things that cost money
15. RESULTS OF HAVING NO MONEY
16. RHETORICAL QUESTIONS, MOSTLY ABOUT MONEY

Things

17. MEDICINE
18. CONTRAST OF PAST TO PRESENT

Questions asked by the interviewer

19. WHAT WE NEED HERE
20. "WOMEN HAVE ALL THE PROBLEMS"
21. TYPES OF TRADITIONAL MEDICINE
22. CHARACTERISTICS OF "LUBEEN"
23. ORIGINS OF DIABETES/Causes
24. VIEWS ON DIET FOR DIABETES

Rationale for agreed final list:

First researcher had 23 domains of which 13 were the same/similar.
Second researcher had 18 domains of which 13 were the same/similar.
I.e. concordance 64% (58% and 72%)
All domains were included except for:
2 of the second researcher's were agreed to be small/not significant
MOBILE PHONE and PATIENTS
2 of the first researcher's which were agreed to be small/not significant
LEVELS OF WEIGHT and LENGTH OF TIME WITH DIABETES

Full taxonomy of agreed domains:

Illnesses

TYPES OF ILLNESSES PATIENTS HAVE
Domain: Strict inclusion

- Hypertension
- Diabetes
- Rheumatism
- Hurting leg

CHARACTERSITICS OF DIABETES/Level of diabetes or sugar
Domain: Attribution

- Low/lowered
- Fine
- Good
- High
- Certain value: nearly 5, 5, 3.6, 1.60, 1.09

LEVELS OF BLOOD PRESSURE
Domain: Attribution

- Fine
- Good
- High
- Certain value: 20

EFFECTS ON HYPERTENSION
Domain: Cause-effect

- If you're angry maybe it's high

- Stress increases it
- Tablets affect it

RESULTS OF STRESS
Domain: Cause-effect

- Increases your blood pressure
- Increases your sugar
- Causes many problems in the world
- Causes many problems in the house

Places

PLACES
Domain: Strict inclusion

- Here – the center
- Hospital
- Home
- Pharmacy
- Clinic Towfiq

"HERE" (THE CENTER)/What patients do "here" (at the health centre)
Domain: Function - Steps

- First step: Come here
- At the centre
    - Get medicine
    - Get medicine for diabetes and hypertension
    - Consult
    - Blood tests
- Final step: Go home

WHAT PATIENTS DO AT THE HOSPITAL
Domain: Function

- Consult
- Get some medicines

CHARACTERISTICS OF "HERE"/Positive aspects of the Centre
Domain: Attribution

- It's good
- The doctors are good
- No problems
- The nurses are good
- Good relationship with the staff: "Me and all my children have been brought up here"
- You get medicine every 15 days from here
- You get consultations right away
- Its 1.5TD to register and then you can be seen
- Always medicine available
- They do blood tests for everything
- Can now register without difficulty

PROBLEMS WITH THE HOSPITALS
Domain: Attribution

- A little far away
- You're left alone
- Places you must wait a long time – you spend the whole day there
- Everything costs money/you need to take a large supply of money/you must have 100TD
- Pay again to do a blood test
- You must return to do a blood test
- Costs money to get there

- Need to get taxi's there and back
- Machines can be broken
- Difficult place to get an appointment soon - You are given an appointment for 1, 1 and a half, 2 or 3 months time
- Others get in first to be seen

People

TYPES OF PEOPLE "HERE"
Domain: Strict inclusion

- Doctors
- Nurses
- Patients
- Nutritionist (Interviewer mentioned)

WHAT DOCTORS DO AT THE CENTRE
Domain: Function

- Write you a letter
- Give you an appointment
- Send you to the hospital: Reasons for:
  - if it is something they don't have
  - eye problems
- See you
- You ask them a little about something
- Tell you if you have diabetes or not
- Do blood tests
- Give out medicines

PATIENT CONTRADICTIONS
Domain: Strict inclusion

- Intra-patient:
  - We don't eat anything with sugar in it / a little bit that's all
  - Medicines for diabetes are always here / if they don't have any you buy it
- Inter-patient
  - They do all the blood tests here / We need a lab for blood tests here

Money issues

WHEN YOU MUST PAY/Things that cost money
Domain: Cause-effect

- Everything, even if you have a carnet
- To get all the blood tests
- To go to the hospital
- To buy the powder to take for an endoscopy
- When you register at the centre
- When you register at the hospital
- At the hospital more than at the centre
- When you have an endoscopy at Clinic Towfiq
- You must take a large supply of money to the hospital
- Transportation to the H
- Xrays at the H
- Blood tests at the H
- The taxi to the H
- When you go to the H
- Analyses at the H
- Analysis of the kidneys
- The doctor at the H

RESULTS OF HAVING NO MONEY
Domain: Cause-effect

- If you have no money you die
- The poor, they don't have enough
- You can't get anything (Everything is with money now)
- You can't go to the hospital

RHETORICAL QUESTIONS, MOSTLY ABOUT MONEY
Domain: Strict inclusion

- What will you do with 100TD?
- What can we do – its necessary? (Context – endoscopy costs 70TD)
- How can people get there (the hospital) in the taxi if they don't have the money?
- Why must one wait a long time and then take taxi's there and back? (Attending the hospital)
- If medications are present they why is it necessary to go to the hospital like this?

Things

MEDICINE
Domain: Function

- For diabetes
- For hypertension
- For rheumatism and sore legs
- For all illnesses

CONTRAST OF PAST TO PRESENT
Domain: Contrast

- Past: Queue in the dark (early morning)
- Present: Register without waiting, not any difficulties, improvement, everything is with money now

Responses to Interviewers Question

WHAT WE NEED HERE
Domain: Strict inclusion

- A large health centre
- An Xray room
- Endoscopies
- Build a laboratory for blood tests
- Do Xrays
- Medicines present
- Doctors present
- Nurses present
- Make everything available
- To be able to stay here

"WOMEN HAVE ALL THE PROBLEMS"
Domain: Strict inclusion

- In their head
- Iller
- More tired
- Having to look after everything
- If she dies he'll marry again
- Women worry about everything
- Its how God made it
- Men don't have many problems
- Men can marry again if a woman dies

TYPES OF HERBAL MEDICINES
Domain: Strict inclusion

- "Lubeen"

CHARACTERISTICS OF "LUBEEN"
Domain: Attribution

- Doesn't have any bad effects
- Doesn't give one "gas"
- You take it when you feel unwell/sometimes/not every day
- It's good for diabetes
- You drink it in water

ORIGINS OF DIABETES/Causes
Domain: Inclusion

- They say it's inherited
- Can be inherited from spouse or in-laws
- Stress, which increases blood pressure and sugar
- They are not overweight

VIEWS ON DIET FOR DIABETES
Domain: Attribution

- We don't eat anything with sugar in it
- We eat a little sugar only
- A diet is necessary
- They start us on it and we follow it
- Its hard at first but you get used to it

Appendix 6.2: Suggestions to improve care

All suggestions are from doctors unless indicated.
Numbers in brackets are the number of people who made the suggestion (1 if not indicated).

Personnel

- Increase the number of doctors *(5 including 1 patient)*
- Recruit a dietician *(5)*
- Eye specialist to consult at the health centre *(3 including 1 patient and 1 staff)*
- Other specialists at the centre *(4 including 2 patients and 1 staff)*
- Bussing in patients from different areas to the specialist and maybe prioritising who gets sent *(2)*
- Increase the number of paramedical staff *(staff)*
- Improve communication between staff and patients *(patient)*
- Send experts to the centres to listen to them and the problems and work out solutions together
- Specialists to travel occasionally to the different health centres *(health manager)*
- Doctors should start work on time *(patient)*

Training

- Train doctors within the framework of the national program *(5)*
- Training in ophthalmoscopy *(3)*
- Training of paramedical staff *(2)*
- Train paramedical staff about the national program
- Training for doctors as workshops
- Train all personnel in dietary education
- A lot more education for the personnel and the doctors
- The same training of the national program for staff and doctors
- Teach the national program in the universities
- The DSSB should have a budget for training
- Training program for primary care doctors in cardiology and endocrinology

Primary health care centre

- Improve provision of medications at the health centres *(11 including 6 patients and 1 staff)*
- Laboratory at the centre *(5 including 2 staff and 1 patient)*
- Better quality medications *(2 patients)*
- ECG machine at the centre *(3 including 1 staff)*
- Xrays at the centre (*3 including 1 patient)*
- Add a second day per week for the chronic disease clinic (CDC)*(2)*
- More organised system for calling patients *(3 all patients)*
- Hold CDCs on an afternoon (2)
- To only see patients with chronic illnesses on the day of the CDC
- Reduce the number of patients at each clinic
- To appoint a person to be responsible for the follow-up of patients
- Provision of a sugar-free cough medicine for diabetics
- Dialysis unit at the heath centre *(patient)*
- More blood tests e.g. thyroid, creatinine *(patient)*
- Doctors should start work earlier (7.30 or 8am) *(patient)*

- Employ someone at each centre to give health advice to people as they are waiting and to visit homes to remind people to attend
- A time as well as a day be given for each patients appointment *(staff)*
- Close smaller centres
- More air-conditioners *(staff)*

Infrastructure
- A nearby university hospital *(4 including 1 staff)*
- Better distribution of resources across the country *(patient)*
- Good management in secondary care
- Public health education
- Promote health education of the population, e.g. using a nutritionist.
- Patient-held records
- Nurses to visit patient in their homes and to even take blood tests

National program
- Increased resources for the national program *(3 including 1 staff)*
- Multiply regional and local supervision visits within the program *(2)*
- Evaluate the program
- Produce educational materials for patients, e.g. video-cassette
- Design a didactic leaflet/poster
- Hold a meeting of the doctors in the region regarding the program to ask them what the problems are
- Teach the national program in the medical schools

Patients
- Encourage patients with diabetes to buy glucometers and to learn to use them
- Financial help for patients
- More patient education
- Place a picture of the insulin syringe on the prescription (designed by the doctor who suggested it)
- Hold patient education groups

Appendix 6.3: Examples of good practice

At the primary health care centre

- Patients are given a card with a coloured number on when they arrive. The number relates to their order in the queue and the colour to which doctor they are to see.
- They have a 'circuit of care'. Patients go to the first reception to pay, the second reception to get their notes, the dietician to be weighed and educated, the nurse for a random glucose test if necessary, then the doctor, then the secretary for their next appointment date and lastly the pharmacy. They are planning to put a map of the centre on the wall for the patients.
- Other centres have a system in which the nurse weighs the patient and measures their blood pressure, prior to seeing the doctor.
- The nurse takes the patients blood pressure in the waiting room after the patient has been sat for a while.
- Clear charts and figures on the wall with the number of patients managed within each national program.
- All entries in the medical records have a number by the date; patients are given a number when they arrive and are called out by their number.
- Helpful signs and posters in the waiting room about the weekly chronic disease clinic and other clinics.
- A number of health centres run patient education groups in the centre prior to the patients being seen by the doctors.
- Some health managers say that if one centre is lacking essential medications then they'll get it from another. (Seen in practice)
- In one region an ophthalmologist visits some health centres to consult patients.

Chronic disease clinics (CDC)

- Introduction of chronic disease clinics.
- One health centre holds doctors' surgeries twice a week only, but still committed one of the two days to being a CDC.
- A few centres do more than one CDC each week.

Use of the medical records

- General use of the new medical records.
- They staple the letter from the eye specialist to the inside front cover of the records.
- They have a marking system indicating if patients have attended well (within 15 days of their appointment) and taken their medication well (within 3 days for tablets or 24 hours for insulin).
- Old medical records stapled into an envelope at the back of the new records.
- One doctor crosses out the old medical records to stop the replacement doctors using the old records instead of the new ones, as tended to happen in the past.
- Medical records placed into individual plastic covers or brown envelopes to keep them from getting dirty or worn out.

Consultations

- Using low does aspirin for patients with hypertension and diabetes.
- Some doctors had a large board or piece of paper with all the tablets stuck on in order to ask the patients which medication they took.

- Another doctor had each of the diabetes/hypertension tablets stuck onto a stick to show the patients.
- One doctor had his own conversion chart of g/l to mmol/l as patients always ask for it in g/l.
- One doctor designed a sheet for doing repeated blood pressure measurements.

Motivated clinicians

- A new doctor held meetings with the other doctors to discuss how they could together improve the care of patients with diabetes by implementing the national program.
- One doctor summarises the old medical records in a page at the back of the new records so that you have the old information.
- Some doctors take records home to complete/summarise.
- Some doctors with a heavy patient workload were still able to perform all the clinical process of care measures required.
- Some doctors regularly referred patients for all the blood tests and examination required within the national program.
- Some doctors give 10 or 15 minutes to each patient.
- Some doctors start work at 8am and others work until 1.30pm or 2pm.
- One doctor goes to see some patients at home, e.g. if they have had a stroke. He says he finds the time because he wants to work well.
- One region commenced training primary health care doctors to perform fundoscopy and the national program has encouraged others to do so.

Appendix 7.1: Full coding tree of content analysis using NVivo software computer package

Coded factor	Number of passages coded
(2) /Patient	0
(2 1) /Patient/Self-monitoring	5
(2 2) /Patient/Unstable population	1
(2 3) /Patient/Family	0
(2 3 1) /Patient/Family/Education	2
(2 4) /Patient/Compliance	15
(2 4 1) /Patient/Compliance/Dietary	44
(2 4 1 1) /Patient/Compliance/Dietary/Cost	14
(2 4 1 2) /Patient/Compliance/Dietary/Tunisian	1
(2 4 1 4) /Patient/Compliance/Dietary/Festivals	2
(2 4 1 5) /Patient/Compliance/Dietary/Being hosted	2
(2 4 2) /Patient/Compliance/Medication	64
(2 4 2 1) /Patient/Compliance/Medication/Ramadan	2
(2 4 2 2) /Patient/Compliance/Medication/Size of tabs	0
(2 4 2 5) /Patient/Compliance/Medication/Insulin	2
(2 4 3) /Patient/Compliance/referrals	27
(2 4 4) /Patient/Compliance/Exercise	4
(2 4 5) /Patient/Compliance/foot advice	1
(2 4 6) /Patient/Compliance/Blood tests	20
(2 4 7) /Patient/Compliance/ECG	3
(2 5) /Patient/Motivation	2
(2 6) /Patient/Socio-economic issues	8
(2 6 1) /Patient/Socio-economic issues/Big families	2
(2 6 3) /Patient/Socio-economic issues/Financial issues	61
(2 6 4) /Patient/Socio-economic issues/Immigration	1
(2 6 5) /Patient/Socio-economic issues/Occupation	7
(2 6 15) /Patient/Socio-economic issues/Social class	1
(2 6 16) /Patient/Socio-economic issues/Literacy	16
(2 6 24) /Patient/Socio-economic issues/Housing	1
(2 7) /Patient/Other illnesses	1
(2 8) /Patient/Education	57
(2 9) /Patient/Gender issues	52
(2 10) /Patient/Preference for Primary or Secondary Care	6
(2 11) /Patient/Knowledge	0
(2 11 1) /Patient/Knowledge/Dietary	2
(2 11 2) /Patient/Knowledge/Medication	2
(2 11 11) /Patient/Knowledge/Of diabetes and hypertension	18
(2 11 21) /Patient/Knowledge/Of saccharine	1
(2 11 22) /Patient/Knowledge/Of diabetes management	4
(2 12) /Patient/Age	17
(2 14) /Patient/Beliefs	2
(2 14 1) /Patient/Beliefs/Too much emphasis on diabetes	1
(2 14 2) /Patient/Beliefs/Low expectation of service	1
(2 14 3) /Patient/Beliefs/Fate	6
(2 14 4) /Patient/Beliefs/No interest	1
(2 14 5) /Patient/Beliefs/Don't take diabetes seriously	1

(2 14 6) /Patient/Beliefs/Patients know best	1
(2 14 7) /Patient/Beliefs/Stress increases sugar	13
(2 14 8) /Patient/Beliefs/Must see the doctor	2
(2 14 9) /Patient/Beliefs/Thankful to doctors	1
(2 14 10) /Patient/Beliefs/its the doctors job to decide	1
(2 14 11) /Patient/Beliefs/Symptoms	5
(2 14 12) /Patient/Beliefs/Shock	1
(2 14 13) /Patient/Beliefs/Stress increases blood pressure	5
(2 14 14) /Patient/Beliefs/Salt	0
(2 14 15) /Patient/Beliefs/Blood tests not important	2
(2 14 16) /Patient/Beliefs/No longer has diabetes	0
(2 14 19) /Patient/Beliefs/Denial	1
(2 14 20) /Patient/Beliefs/Chronic illnesses difficult	3
(2 14 22) /Patient/Beliefs/No longer have hypertension	1
(2 14 23) /Patient/Beliefs/Losing wt is harmful	1
(2 14 24) /Patient/Beliefs/Of medication	0
(2 14 24 1) /Patient/Beliefs/Of medication/Prescription most important	18
(2 14 24 5) /Patient/Beliefs/Of medication/Injections effective	3
(2 14 24 16) /Patient/Beliefs/Of medication/Don't like insulin	1
(2 14 24 17) /Patient/Beliefs/Of medication/Get used to meds	1
(2 14 24 18) /Patient/Beliefs/Of medication/Tablets harmful	1
(2 14 24 20) /Patient/Beliefs/Of medication/Can stop meds	2
(2 14 24 21) /Patient/Beliefs/Of medication/Like lots of meds	1
(2 15) /Patient/Herbal Medicine	43
(2 16) /Patient/Lack of Privacy	13
(2 17) /Patient/Distance to clinics	7
(2 18) /Patient/Attendance	35
(2 18 1) /Patient/Attendance/Weather influence	13
(2 18 2) /Patient/Attendance/After holidays	3
(2 18 3) /Patient/Attendance/Vary centres	23
(2 18 4) /Patient/Attendance/Other places	5
(2 18 5) /Patient/Attendance/Frequency	15
(2 18 6) /Patient/Attendance/Ramadan	1
(2 18 7) /Patient/Attendance/Over-attendance	3
(2 18 9) /Patient/Attendance/Time needed	0
(2 18 10) /Patient/Attendance/Patient ill	1
(2 18 11) /Patient/Attendance/Transport	1
(2 18 12) /Patient/Attendance/Market influence	2
(2 18 14) /Patient/Attendance/For acute problems	1
(2 18 15) /Patient/Attendance/For social reasons	1
(2 19) /Patient/Behaviour	1
(2 19 1) /Patient/Behaviour/Demanding	3
(2 19 2) /Patient/Behaviour/Complaining	7
(2 19 3) /Patient/Behaviour/Unsatisfied	2
(2 19 4) /Patient/Behaviour/Appreciative	1
(2 19 5) /Patient/Behaviour/Causes staff illness	1
(2 19 6) /Patient/Behaviour/Upset	1
(2 19 7) /Patient/Behaviour/Depressed	1
(2 19 8) /Patient/Behaviour/Angry	1
(2 22) /Patient/Culture~religious influence	8
(2 23) /Patient/Smoking	4
(2 23 1) /Patient/Smoking/Neffa (snuff)	1

(2 25) /Patient/Satisfaction	2
(2 26) /Patient/Consent	1
(3) /System	2
(3 1) /System/Centres	0
(3 1 1) /System/Centres/Mornings only	21
(3 1 2) /System/Centres/No appt system	3
(3 1 3) /System/Centres/CDC	76
(3 1 3 1) /System/Centres/CDC/Problems	13
(3 1 3 2) /System/Centres/CDC/Training for CDC	2
(3 1 3 3) /System/Centres/CDC/Patients get used to it	5
(3 1 4) /System/Centres/Equipment	0
(3 1 4 2) /System/Centres/Equipment/Computers	9
(3 1 4 9) /System/Centres/Equipment/Lack of equipment	30
(3 1 4 10) /System/Centres/Equipment/Glucometer use	17
(3 1 4 10 1) /System/Centres/Equipment/Glucometer use/Lack of strips	7
(3 1 4 11) /System/Centres/Equipment/Broken equipment	7
(3 1 4 12) /System/Centres/Equipment/Telephone	3
(3 1 4 13) /System/Centres/Equipment/Air conditioner	2
(3 1 4 21) /System/Centres/Equipment/Unused equipment	2
(3 1 4 30) /System/Centres/Equipment/Equipped	5
(3 1 4 33) /System/Centres/Equipment/TV	1
(3 1 4 35) /System/Centres/Equipment/Stolen equipment	3
(3 1 5) /System/Centres/Noisy	4
(3 1 6) /System/Centres/No queuing	2
(3 1 7) /System/Centres/Accessibility	5
(3 1 8) /System/Centres/Quality of care	8
(3 1 9) /System/Centres/Waiting time	33
(3 1 9 1) /System/Centres/Waiting time/Favouritism	7
(3 1 9 2) /System/Centres/Waiting time/Ramadan	1
(3 1 9 3) /System/Centres/Waiting time/Patient late	2
(3 1 9 13) /System/Centres/Waiting time/Diabetic care is time consuming	2
(3 1 14) /System/Centres/Gives medications only	2
(3 1 16) /System/Centres/No queues	1
(3 1 17) /System/Centres/Organised or not	36
(3 1 18) /System/Centres/Unnecessary consultations	1
(3 1 19) /System/Centres/Emergency care	1
(3 1 20) /System/Centres/Rural areas	2
(3 1 22) /System/Centres/Bureaucracy	0
(3 1 23) /System/Centres/Interruptions	2
(3 1 25) /System/Centres/Continued input	1
(3 1 27) /System/Centres/Closes early before feasts	1
(3 1 29) /System/Centres/Personalised system	9
(3 1 37) /System/Centres/The building	0
(3 1 37 10) /System/Centres/The building/Posters	2
(3 1 37 20) /System/Centres/The building/Electricity	4
(3 1 37 24) /System/Centres/The building/Need more room	2
(3 1 37 26) /System/Centres/The building/Condition	7
(3 1 37 28) /System/Centres/The building/Size	9
(3 1 37 32) /System/Centres/The building/Running water	1
(3 1 37 34) /System/Centres/The building/Nice garden	1
(3 1 37 36) /System/Centres/The building/Construction	2
(3 2) /System/Geographical bias	0

(3 2 18) /System/Geographical bias/Capital bias	10
(3 2 34) /System/Geographical bias/Coastal bias	7
(3 3) /System/Accessibility to tests	11
(3 3 1) /System/Accessibility to tests/Taken at centre	2
(3 4) /System/National Program	9
(3 4 34) /System/National Program/Components	0
(3 4 34 3) /System/National Program/Components/Committee	1
(3 4 34 4) /System/National Program/Components/Screening	1
(3 4 34 6) /System/National Program/Components/Workshops	6
(3 4 34 7) /System/National Program/Components/Medical records	6
(3 4 34 7 1) /System/National Program/Components/Medical records/Recording	7
(3 4 34 7 2) /System/National Program/Components/Medical records/Doctors need to ask for copies	1
(3 4 34 7 3) /System/National Program/Components/Medical records/Awareness of them	2
(3 4 34 7 4) /System/National Program/Components/Medical records/Not transferred	1
(3 4 34 7 5) /System/National Program/Components/Medical records/Supply and demand	20
(3 4 34 7 6) /System/National Program/Components/Medical records/Usage or not	31
(3 4 34 7 8) /System/National Program/Components/Medical records/Time to complete	24
(3 4 34 7 10) /System/National Program/Components/Medical records/Other problems	21
(3 4 34 7 11) /System/National Program/Components/Medical records/Good	7
(3 4 34 7 11 1) /System/National Program/Components/Medical records/Good/Reminder	1
(3 4 34 7 11 2) /System/National Program/Components/Medical records/Good/Well developed records	3
(3 4 34 7 13) /System/National Program/Components/Medical records/Who initiates	2
(3 4 34 8) /System/National Program/Components/Materials	11
(3 4 34 8 1) /System/National Program/Components/Materials/Materials - high quality	2
(3 4 34 8 3) /System/National Program/Components/Materials/Availability	13
(3 4 34 8 5) /System/National Program/Components/Materials/Development of educational support	1
(3 4 34 8 6) /System/National Program/Components/Materials/Under-use	3
(3 4 34 8 7) /System/National Program/Components/Materials/Good admin support	1
(3 4 34 12) /System/National Program/Components/Patient-held records	18
(3 4 34 14) /System/National Program/Components/Guidelines	1
(3 4 34 18) /System/National Program/Components/Disease Registers	5
(3 4 34 18 1) /System/National Program/Components/Disease Registers/Prefer old ones	4
(3 4 34 20) /System/National Program/Components/Supervision visits	15
(3 4 34 21) /System/National Program/Components/Nurses trained	1
(3 4 34 22) /System/National Program/Components/Reports	1
(3 4 34 23) /System/National Program/Components/Monitoring	2
(3 4 34 24) /System/National Program/Components/Standardised	3
(3 4 34 25) /System/National Program/Components/DSSB	1
(3 4 34 25 1) /System/National Program/Components/DSSB/Phone line	2
(3 4 34 25 4) /System/National Program/Components/DSSB/Use of money	1
(3 4 34 26) /System/National Program/Components/Medical Coordinator	4
(3 4 34 26 1) /System/National Program/Components/Medical Coordinator/Role	4
(3 4 34 27) /System/National Program/Components/Micral test	13
(3 4 34 28) /System/National Program/Components/Protocols	3
(3 4 34 32) /System/National Program/Components/Chasing up patients	1
(3 4 35) /System/National Program/Views of	0
(3 4 35 1) /System/National Program/Views of/Doctors not using it	5
(3 4 35 2) /System/National Program/Views of/Quality	13
(3 4 35 7) /System/National Program/Views of/Stagnated	1

(3 4 35 8) /System/National Program/Views of/Needs time	2
(3 4 35 9) /System/National Program/Views of/Needs staff	4
(3 4 35 10) /System/National Program/Views of/Nurses don't follow	2
(3 4 35 11) /System/National Program/Views of/No follow up	2
(3 4 35 13) /System/National Program/Views of/Enthusiasm for	2
(3 4 35 15) /System/National Program/Views of/Not important	1
(3 4 35 17) /System/National Program/Views of/Too many others	5
(3 4 35 19) /System/National Program/Views of/Still new	3
(3 4 35 22) /System/National Program/Views of/Politics	4
(3 4 35 25) /System/National Program/Views of/Unrealistic	2
(3 4 35 27) /System/National Program/Views of/Lack of evaluation	1
(3 4 35 29) /System/National Program/Views of/Covers diabetes and hypertension	2
(3 4 35 30) /System/National Program/Views of/Started well	6
(3 4 35 31) /System/National Program/Views of/Lacks resources	2
(3 4 35 33) /System/National Program/Views of/Western	0
(3 5) /System/Private System	31
(3 6) /System/Primary Care	1
(3 7) /System/Set up for acute care	2
(3 8) /System/Medication	0
(3 8 1) /System/Medication/Availability	157
(3 8 1 1) /System/Medication/Availability/Prevents ACE inhibitor use	4
(3 8 2) /System/Medication/Cost	12
(3 8 2 1) /System/Medication/Cost/Syringes	1
(3 8 2 14) /System/Medication/Cost/Previously free	1
(3 8 3) /System/Medication/Appropriate use	4
(3 8 4) /System/Medication/Previously dispensed only	2
(3 8 5) /System/Medication/Generics	1
(3 8 6) /System/Medication/No containers	4
(3 8 7) /System/Medication/Prescriptions not written	5
(3 8 8) /System/Medication/Difficulties	1
(3 8 9) /System/Medication/Quality	8
(3 8 10) /System/Medication/Distribution	7
(3 8 11) /System/Medication/Availability at hospitals	2
(3 8 12) /System/Medication/Side-effects	5
(3 8 13) /System/Medication/Use of injections	7
(3 8 14) /System/Medication/Ambulatoire	2
(3 8 15) /System/Medication/Doctors over prescribe	4
(3 8 16) /System/Medication/Insulin pens	1
(3 8 17) /System/Medication/Staff taking	2
(3 8 18) /System/Medication/Insulin problems	4
(3 8 19) /System/Medication/Large number tablets	2
(3 8 20) /System/Medication/Changes	1
(3 8 21) /System/Medication/Dose changes	1
(3 8 22) /System/Medication/Every 15 days	1
(3 9) /System/Ministry of health	0
(3 9 1) /System/Ministry of health/Awareness	1
(3 10) /System/Emphasis or not on chronic diseases	8
(3 11) /System/Public awareness	1
(3 12) /System/ECGs	0
(3 12 1) /System/ECGs/Waiting times	1
(3 13) /System/Large number of patients	77
(3 14) /System/Administration	2

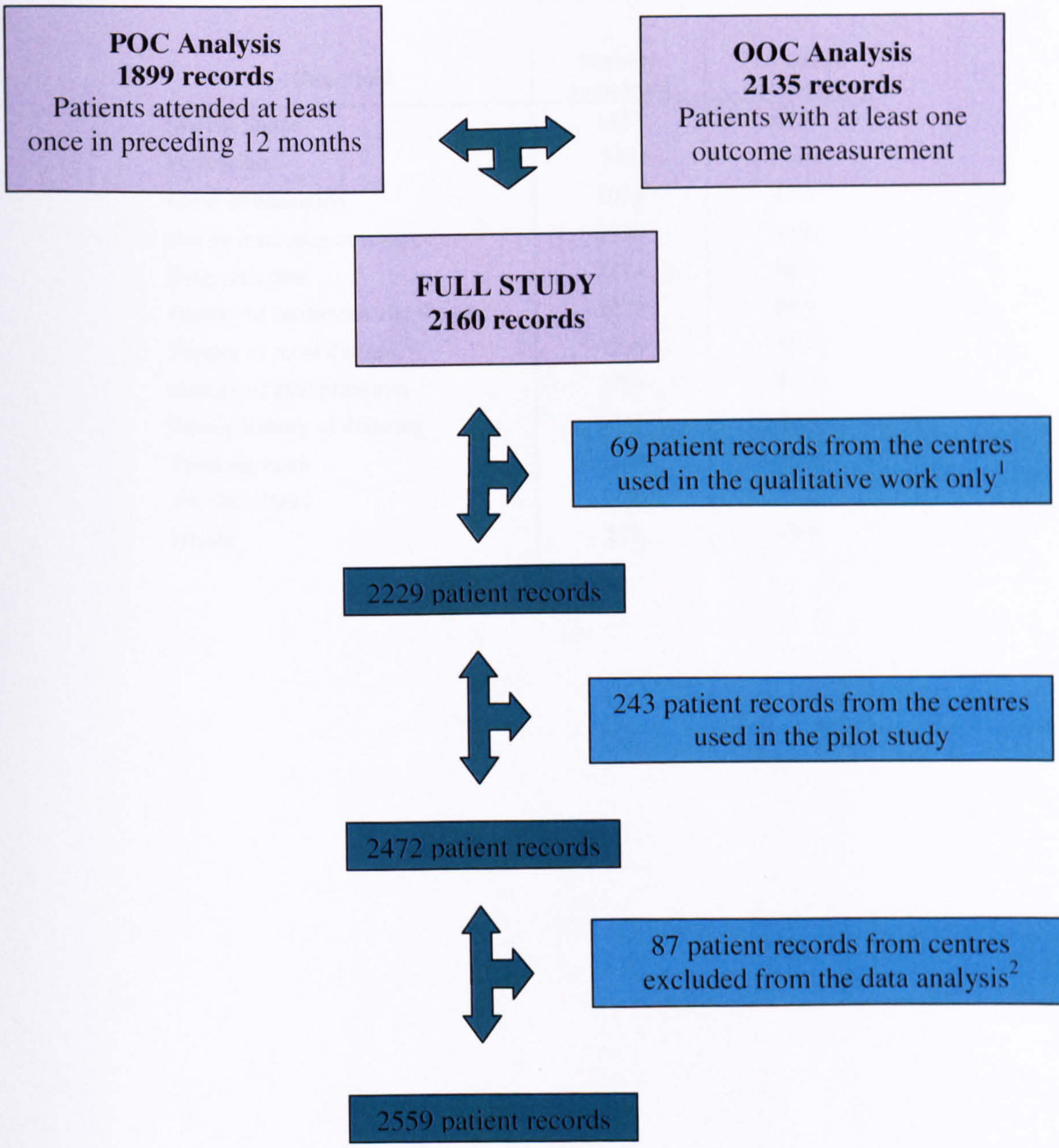
(3 14 1) /System/Administration/Centralised	1
(3 14 2) /System/Administration/Unhelpful	16
(3 14 3) /System/Administration/Try to look good	2
(3 14 4) /System/Administration/Not co-ordinated	1
(3 14 5) /System/Administration/Strictness	3
(3 14 6) /System/Administration/Incompetent	1
(3 14 7) /System/Administration/Role	2
(3 14 8) /System/Administration/Well financed	1
(3 14 10) /System/Administration/Disagree with doctorrs	1
(3 14 15) /System/Administration/Governors influence	1
(3 14 32) /System/Administration/Regional directors	3
(3 14 33) /System/Administration/Local directors	1
(3 15) /System/Transport	12
(3 20) /System/Laboratory issues	21
(3 20 1) /System/Laboratory issues/HbA1c	42
(3 20 2) /System/Laboratory issues/Lipids	4
(3 20 3) /System/Laboratory issues/Lost results	5
(3 20 4) /System/Laboratory issues/Not trusted	2
(3 20 5) /System/Laboratory issues/Shortage	1
(3 20 6) /System/Laboratory issues/Wrong names	1
(3 23) /System/Appointments	2
(3 23 1) /System/Appointments/Foreign concept	1
(3 26) /System/CNSS	7
(3 27) /System/Hospitals	1
(3 27 1) /System/Hospitals/New	2
(3 27 2) /System/Hospitals/Problems	9
(3 27 3) /System/Hospitals/Waiting times	37
(3 27 4) /System/Hospitals/Patients fear	1
(3 27 5) /System/Hospitals/Drs trainees	1
(3 27 6) /System/Hospitals/Staff rude	1
(3 27 7) /System/Hospitals/Military	1
(3 27 9) /System/Hospitals/Good	3
(3 27 10) /System/Hospitals/Organised	1
(3 27 12) /System/Hospitals/Distance	40
(3 27 13) /System/Hospitals/Lack of Equipment	4
(3 27 15) /System/Hospitals/Not seen often enough	1
(3 27 16) /System/Hospitals/Advantages	5
(3 27 17) /System/Hospitals/Posh	2
(3 28) /System/Statistics	6
(3 31) /System/Resources	31
(3 31 1) /System/Resources/Uneven distribution	5
(3 31 25) /System/Resources/High costs of chronic diseases	1
(3 35) /System/Intermediate Centre	7
(3 36) /System/Drug Reps	4
(3 37) /System/Public health and PHC	2
(4) /H~Professionals	0
(4 1) /H~Professionals/Training	10
(4 2) /H~Professionals/Staff-patient communication	24
(4 3) /H~Professionals/Nurses	1
(4 3 1) /H~Professionals/Nurses/Role	42
(4 3 2) /H~Professionals/Nurses/Patient care	6
(4 3 4) /H~Professionals/Nurses/Don't follow advice	7

(4 3 5) /H~Professionals/Nurses/Vary	2
(4 3 6) /H~Professionals/Nurses/Low morale	4
(4 3 7) /H~Professionals/Nurses/Low pay	6
(4 3 8) /H~Professionals/Nurses/Beliefs	2
(4 3 8 3) /H~Professionals/Nurses/Beliefs/Diet important	2
(4 3 8 19) /H~Professionals/Nurses/Beliefs/Unwilling to change	1
(4 3 11) /H~Professionals/Nurses/Smoking	1
(4 3 12) /H~Professionals/Nurses/Patient Instruction	2
(4 3 13) /H~Professionals/Nurses/Work hours	1
(4 3 14) /H~Professionals/Nurses/Education	3
(4 3 15) /H~Professionals/Nurses/Knowledge	4
(4 3 16) /H~Professionals/Nurses/Length of time at centre	2
(4 3 17) /H~Professionals/Nurses/Workload	1
(4 3 18) /H~Professionals/Nurses/Careers	1
(4 3 19) /H~Professionals/Nurses/Gender	5
(4 3 20) /H~Professionals/Nurses/Home visits	1
(4 3 21) /H~Professionals/Nurses/Doctors unhappy with	1
(4 3 22) /H~Professionals/Nurses/Motivation	12
(4 3 23) /H~Professionals/Nurses/Conscience	2
(4 3 24) /H~Professionals/Nurses/Unfriendly	1
(4 4) /H~Professionals/Receptionists	1
(4 5) /H~Professionals/Doctors	0
(4 5 13) /H~Professionals/Doctors/Doctors training	11
(4 5 13 1) /H~Professionals/Doctors/Doctors training/Not the problem	6
(4 5 13 2) /H~Professionals/Doctors/Doctors training/Incentives	1
(4 5 13 3) /H~Professionals/Doctors/Doctors training/Lack of	27
(4 5 13 4) /H~Professionals/Doctors/Doctors training/Expectation	2
(4 5 13 5) /H~Professionals/Doctors/Doctors training/Practical difficulties	5
(4 5 13 6) /H~Professionals/Doctors/Doctors training/Practical not theoretical	1
(4 5 13 7) /H~Professionals/Doctors/Doctors training/Self-initiated	2
(4 5 13 8) /H~Professionals/Doctors/Doctors training/Masters	1
(4 5 13 11) /H~Professionals/Doctors/Doctors training/Quality	9
(4 5 16) /H~Professionals/Doctors/Shortage	24
(4 5 16 30) /H~Professionals/Doctors/Shortage/Unequal distribution	3
(4 5 33) /H~Professionals/Doctors/Placement	28
(4 5 33 1) /H~Professionals/Doctors/Placement/Favouritism	5
(4 5 52) /H~Professionals/Doctors/Role	6
(4 5 52 19) /H~Professionals/Doctors/Role/Cover smaller centres	2
(4 5 52 31) /H~Professionals/Doctors/Role/Nightshifts	3
(4 5 52 36) /H~Professionals/Doctors/Role/Cover emergency care	6
(4 5 52 49) /H~Professionals/Doctors/Role/Role of co-ordinator	7
(4 5 52 50) /H~Professionals/Doctors/Role/Rotate	3
(4 5 63) /H~Professionals/Doctors/Views	0
(4 5 63 23) /H~Professionals/Doctors/Views/Self-confidence	1
(4 5 63 24) /H~Professionals/Doctors/Views/Importance of primary health care doctors	1
(4 5 63 26) /H~Professionals/Doctors/Views/Over estimation of care	2
(4 5 63 42) /H~Professionals/Doctors/Views/Nurse preference	3
(4 5 63 53) /H~Professionals/Doctors/Views/PHC Doctors devalued	6
(4 5 63 54) /H~Professionals/Doctors/Views/Beliefs	5
(4 5 63 55) /H~Professionals/Doctors/Views/No change culture	1
(4 5 64) /H~Professionals/Doctors/Characteristics	0
(4 5 64 4) /H~Professionals/Doctors/Characteristics/Group Environment	3

(4 5 64 4 6) /H~Professionals/Doctors/Characteristics/Group Environment/Doctors lack of peer pressure	3
(4 5 64 4 18) /H~Professionals/Doctors/Characteristics/Group Environment/Does everything himself	1
(4 5 64 4 21) /H~Professionals/Doctors/Characteristics/Group Environment/Pressure to finish quickly	6
(4 5 64 5) /H~Professionals/Doctors/Characteristics/Education	1
(4 5 64 7) /H~Professionals/Doctors/Characteristics/Wages	6
(4 5 64 11) /H~Professionals/Doctors/Characteristics/Motivation	91
(4 5 64 11 1) /H~Professionals/Doctors/Characteristics/Motivation/Convictions	7
(4 5 64 11 2) /H~Professionals/Doctors/Characteristics/Motivation/Ownership	1
(4 5 64 11 3) /H~Professionals/Doctors/Characteristics/Motivation/Self-worth	1
(4 5 64 11 15) /H~Professionals/Doctors/Characteristics/Motivation/Interest	2
(4 5 64 17) /H~Professionals/Doctors/Characteristics/Gender	10
(4 5 64 20) /H~Professionals/Doctors/Characteristics/Age	13
(4 5 64 25) /H~Professionals/Doctors/Characteristics/Knowledge	5
(4 5 64 29) /H~Professionals/Doctors/Characteristics/Principal	1
(4 5 64 35) /H~Professionals/Doctors/Characteristics/Unemployed	4
(4 5 64 38) /H~Professionals/Doctors/Characteristics/Smoking	4
(4 5 64 39) /H~Professionals/Doctors/Characteristics/Clothing	3
(4 5 64 40) /H~Professionals/Doctors/Characteristics/Low morale	9
(4 5 64 41) /H~Professionals/Doctors/Characteristics/Ill	5
(4 5 64 45) /H~Professionals/Doctors/Characteristics/Single-handed	5
(4 5 64 46) /H~Professionals/Doctors/Characteristics/Nationality	1
(4 5 64 48) /H~Professionals/Doctors/Characteristics/Religion	2
(4 5 64 51) /H~Professionals/Doctors/Characteristics/Complain	1
(4 5 64 59) /H~Professionals/Doctors/Characteristics/Birthplace	1
(4 5 64 62) /H~Professionals/Doctors/Characteristics/Other interests	1
(4 5 64 63) /H~Professionals/Doctors/Characteristics/Strict	1
(4 5 65) /H~Professionals/Doctors/Actions	0
(4 5 65 1) /H~Professionals/Doctors/Actions/Doctors appropriate actions	2
(4 5 65 2) /H~Professionals/Doctors/Actions/Doctors decision making illogical	1
(4 5 65 9) /H~Professionals/Doctors/Actions/Work effort	2
(4 5 65 22) /H~Professionals/Doctors/Actions/Patient examination	1
(4 5 65 22 1) /H~Professionals/Doctors/Actions/Patient examination/Feet	9
(4 5 65 22 2) /H~Professionals/Doctors/Actions/Patient examination/Fundoscopy	26
(4 5 65 22 19) /H~Professionals/Doctors/Actions/Patient examination/Blood pressure	21
(4 5 65 22 19 1) /H~Professionals/Doctors/Actions/Patient examination/Blood pressure/Doctors job	2
(4 5 65 34) /H~Professionals/Doctors/Actions/Work time	34
(4 5 65 34 1) /H~Professionals/Doctors/Actions/Work time/Fasting	1
(4 5 65 37) /H~Professionals/Doctors/Actions/Work distribution	3
(4 5 65 43) /H~Professionals/Doctors/Actions/Focus on acute	1
(4 5 65 44) /H~Professionals/Doctors/Actions/Research	4
(4 5 65 47) /H~Professionals/Doctors/Actions/Replacements	12
(4 5 65 56) /H~Professionals/Doctors/Actions/No-one checks quality	1
(4 5 65 57) /H~Professionals/Doctors/Actions/Prioritise family	1
(4 5 65 58) /H~Professionals/Doctors/Actions/Say one thing but do another	1
(4 5 65 60) /H~Professionals/Doctors/Actions/Referral behaviour	10
(4 5 65 61) /H~Professionals/Doctors/Actions/Clinically minded	1
(4 5 65 64) /H~Professionals/Doctors/Actions/time at centre	1
(4 6) /H~Professionals/Secretaries	1
(4 8) /H~Professionals/Nutritionist	9

(4 8 1) /H~Professionals/Nutritionist/Role	11
(4 8 4) /H~Professionals/Nutritionist/shortage	17
(4 9) /H~Professionals/Work ethic	3
(4 12) /H~Professionals/Teamwork	29
(4 14) /H~Professionals/Pharmacists	1
(4 14 1) /H~Professionals/Pharmacists/Role	4
(4 16) /H~Professionals/Hierarchy	2
(4 17) /H~Professionals/Specialists	7
(4 17 1) /H~Professionals/Specialists/Caravan	5
(4 17 2) /H~Professionals/Specialists/Lack of feedback	28
(4 17 3) /H~Professionals/Specialists/Don't refer for fundoscopy	1
(4 17 5) /H~Professionals/Specialists/Cost	8
(4 17 6) /H~Professionals/Specialists/Duplicity	2
(4 17 7) /H~Professionals/Specialists/Shortage	29
(4 17 8) /H~Professionals/Specialists/Foreign	13
(4 17 10) /H~Professionals/Specialists/Placement	1
(4 17 11) /H~Professionals/Specialists/Patient education	1
(4 17 12) /H~Professionals/Specialists/No communication with them	18
(4 17 13) /H~Professionals/Specialists/Keep their patients	1
(4 17 14) /H~Professionals/Specialists/Vary	1
(4 17 15) /H~Professionals/Specialists/Problems	4
(4 19) /H~Professionals/Shortage of staff	36
(4 20) /H~Professionals/Unequal distribution	1
(4 21) /H~Professionals/Dr-patient	0
(4 21 1) /H~Professionals/Dr-patient/Relationship	21
(4 21 2) /H~Professionals/Dr-patient/Dr preference	20
(4 21 3) /H~Professionals/Dr-patient/Explanation	9
(4 21 4) /H~Professionals/Dr-patient/Fear	1
(4 21 5) /H~Professionals/Dr-patient/Home visit	1
(4 21 6) /H~Professionals/Dr-patient/Communication	12
(4 21 8) /H~Professionals/Dr-patient/Doctors Time with patients	43
(4 23) /H~Professionals/Smoke in centre	1
(4 24) /H~Professionals/Health care assistant	0
(4 24 1) /H~Professionals/ Health care assistant/Role	3
(4 24 2) /H~Professionals/ Health care assistant/Pay	1
Total	**3083**

Appendix 9.1: Flow chart demonstrating the selection of medical records for the study



POC: Process of care, OOC: Outcome of care

[1] This number includes 12 extra records from centre B only as this center was also one of the 48 centres in the quantitative phase. The 75 records from centre A were included in the number from the pilot study as centre A was also one of the centers used in the pilot study.

[2] Reasons for exclusion were: 50 records from four health centres were excluded as it was discovered on site that the health centre was open less than 4 days a week for medical consultations, 25 records from three health centres were excluded as the health centres had a total of less than 20 patients with diabetes, 12 records were excluded from included health centres that already had a maximum of 50 records included.

Appendix 9.2

Table 9.18: Completion of disease-specific medical records

Data Field	Number completed	Percentage completed
Marital Status	1487	68.8
Profession	980	45.4
Level of education	1025	47.5
Health insurance coverage	1589	73.6
Diagnosis date	1493	69.1
History of cardiovascular disease	1273	58.9
History of renal disease	1229	56.9
History of dyslipidaemia	1195	55.3
Family history of diabetes	1311	60.7
Smoking habit	1223	56.6
Alcohol intake	1106	51.2
Height	878	40.6

Appendix 9.3: Additional longitudinal analysis data

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Table 9.19 Process measure carried out each year (%) in the national cohort: 2000 to 2002.

	2000 *(n=931)*	2001 *(n=1278)*	2002 *(n=1516)*	p-value[1]
Fasting glucose	88.5	90.9	91.3	*0.026*
Blood pressure	89.9	90.0	91.6	*0.12*
Weight	47.9	50.1	52.2	*0.036*
CVS Examination	46.9	54.1	54.7	*<0.001*
Foot Examination	39.4	42.9	43.8	*0.042*
Cholesterol	36.3	42.3	45.2	*0.001*
Creatinine	22.1	24.5	28.2	*<0.001*
Electrocardiogram	15.1	12.1	14.5	*0.41*
Fundoscopy	10.6	8.4	11.2	*0.90*
HbA1c	0.8	2.3	4.2	*<0.001*

[1] Chi-squared test for trend

Table 9.20 Process measure carried out each year (%) in the south: 2000-2004

	2000 *(n=250)*	2001 *(n=351)*	2002 *(n=416)*	2003 *(n=456)*	2004 *(n=488)*	p-value[1]
Fasting glucose	95.6	96.3	97.1	98.2	97.5	*0.049*
Blood pressure	91.6	94.3	95.4	96.0	96.3	*<0.005*
Weight	44.8	50.4	51.4	53.3	58.4	*<0.001*
CVS Examination	46.0	55.5	52.2	53.3	54.3	*0.17*
Foot Examination	43.2	45.9	41.6	41.4	39.5	*0.12*
Cholesterol	45.2	47.0	53.8	54.2	59.8	*<0.001*
Creatinine	31.2	32.8	39.2	42.8	52.9	*<0.001*
Electrocardiogram	19.6	10.8	14.9	8.8	16.6	*0.50*
Fundoscopy	13.2	9.7	13.0	7.9	9.2	*0.06*
HbA1c	0.8	3.7	3.6	1.7	1.8	*0.59*

[1] Chi-squared test for trend

Table 9.21 ***Process measure carried out each year (%) in the national cohort, patients with type 2 diabetes only: 2000 to 2002***

	2000 *(n=877)*	2001 *(n=1197)*	2002 *(n=1433)*	p-value[1]
Fasting glucose	89.0	91.3	91.8	*0.030*
Blood pressure	91.0	91.1	93.1	*0.050*
Weight	47.0	50.4	52.8	*0.006*
CVS Examination	46.3	54.0	54.7	*<0.001*
Foot Examination	38.5	42.4	44.0	*<0.012*
Cholesterol	37.0	43.3	46.5	*<0.001*
Creatinine	22.4	25.2	28.7	*<0.001*
Electrocardiogram	15.4	12.4	14.7	*0.88*
Fundoscopy	10.3	7.8	11.4	*0.20*
HbA1c	0.9	2.3	4.1	*<0.001*

[1]Chi-squared test for trend

Table 9.22 ***Process measure carried out each year (%) in the southern cohort, patients with type 2 diabetes only, 2000 to 2004***

	2000 *(n=230)*	2001 *(n=334)*	2002 *(n=394)*	2003 *(n=423)*	2004 *(n=458)*	p-value[1]
Fasting glucose	95.0	96.1	97.5	98.3	97.4	*0.030*
Blood pressure	92.5	95.5	96.7	97.2	96.9	*0.005*
Weight	47.9	51.2	51.8	53.2	58.7	*0.004*
CVS Examination	46.7	55.7	51.5	50.6	54.8	*0.28*
Foot Examination	44.2	45.8	41.4	40.7	39.1	*0.06*
Cholesterol	45.4	48.2	54.8	55.3	61.8	*<0.001*
Creatinine	30.4	34.1	39.1	43.3	54.1	*<0.001*
Electrocardiogram	19.6	11.4	14.8	9.2	16.8	*0.54*
Fundoscopy	12.9	9.3	12.9	7.6	9.6	*0.13*
HbA1c	0.8	3.9	3.8	1.9	1.9	*0.64*

[1]Chi-squared test for trend

Table 9.23 Process measure carried out (%) in the national cohort in patients seen every year: 2000 to 2002 (n=940)

	2000	2001	2002	p-value[1]
Fasting glucose	87.1	89.8	88.3	*0.48*
Blood pressure	88.1	90.4	91.5	*0.014*
Weight	49.8	48.0	46.8	*0.20*
CVS Examination	48.2	51.0	50.6	*0.29*
Foot Examination	41.1	39.2	40.8	*0.93*
Cholesterol	34.0	38.3	40.1	*0.007*
Creatinine	21.0	22.3	25.1	*0.032*
Electrocardiogram	15.0	9.1	11.1	*0.040*
Fundoscopy	10.7	7.8	8.5	*0.09*

[1]Chi-squared test for trend

Table 9.24 Process measure carried out (%) in the southern cohort in patients seen every year: 2000 to 2004 (n=394)

	2000	2001	2002	2003	2004	p-value[1]
Fasting glucose	87.3	91.1	90.6	90.3	92.5	*0.042*
Blood pressure	89.1	92.4	93.6	92.6	91.9	*0.18*
Weight	57.4	51.3	46.4	45.2	45.4	*<0.005*
CVS Examination	54.8	61.4	56.3	53.5	55.3	*0.39*
Foot Examination	52.0	51.3	40.9	35.8	34.8	*<0.001*
Cholesterol	37.0	43.1	46.2	41.4	44.2	*0.11*
Creatinine	21.1	27.9	26.6	28.4	33.2	*<0.005*
Electrocardiogram	18.5	9.4	13.7	10.1	12.2	*0.026*
Fundoscopy	12.7	9.9	9.4	4.1	6.8	*<0.001*

[1]Chi-squared test for trend

Table 9.25 Paired comparison of outcomes in the national cohort, patients with type 2 diabetes only: 2000 and 2002

	Number	Mean 2000	Mean 2002	Mean Difference (95% Confidence Intervals)	t or z statistic	p-value[1]
Fasting glucose (mmol/l)	710	10.4	10.2	0.21 (-0.03 to 0.45)	t=1.75	*0.08*
Total cholesterol (mmol/l)	169	5.23	5.22	0.01 (-0.17 to 0.20)	t=0.14	*0.89*
SBP (mmHg)	758	141.7	141.6	0.06 (-1.16 to 1.27)	t=0.09	*0.93*
DBP (mmHg)	758	81.0	81.7	-0.74 (-1.48 to 0.00)	t=-1.97	*0.050*
BMI (kg/m^2)	222	28.8	28.3	0.49 (0.29 to 0.70)	t=4.70	*<0.001*
Creatinine (µmol/l)	89	87.2	99.3	-12.06 (-22.37 to –1.75)	z=-2.48	*0.013*

Table 9.26 Paired comparison of outcomes in the southern cohort, patients with type 2 diabetes only: 2000 and 2004

	Number	Mean 2000	Mean 2004	Mean Difference (95% Confidence Intervals)	t or z statistic	p-value[1]
Fasting glucose (mmol/l)	206	10.6	10.1	0.43 (-0.07 to 0.93)	t=1.68	*0.10*
Total cholesterol (mmol/l)	66	5.26	4.95	0.31 (0.04 to 0.58)	t=2.32	*0.024*
SBP (mmHg)	201	143.2	143.7	-0.51 (-2.99 to 1.96)	t=-0.41	*0.68*
DBP (mmHg)	201	80.7	79.9	0.87 (-0.45 to 2.19)	t=1.30	*0.20*
BMI (kg/m^2)	73	28.4	27.9	0.51 (0.15 to 0.87)	t=2.80	*0.007*
Creatinine (µmol/l)	42	94.6	101.7	-7.07 (-19.89 to 5.76)	z=-0.59	*0.56*

[1] paired t-test for variables with a normal distribution, otherwise Wilcoxon signed rank test
SBP: Systolic blood pressure, DBP: Diastolic blood pressure, BMI: Body mass index

Table 9.27 Trend of outcomes in the national cohort, patients with type 2 diabetes only: 2000 to 2002

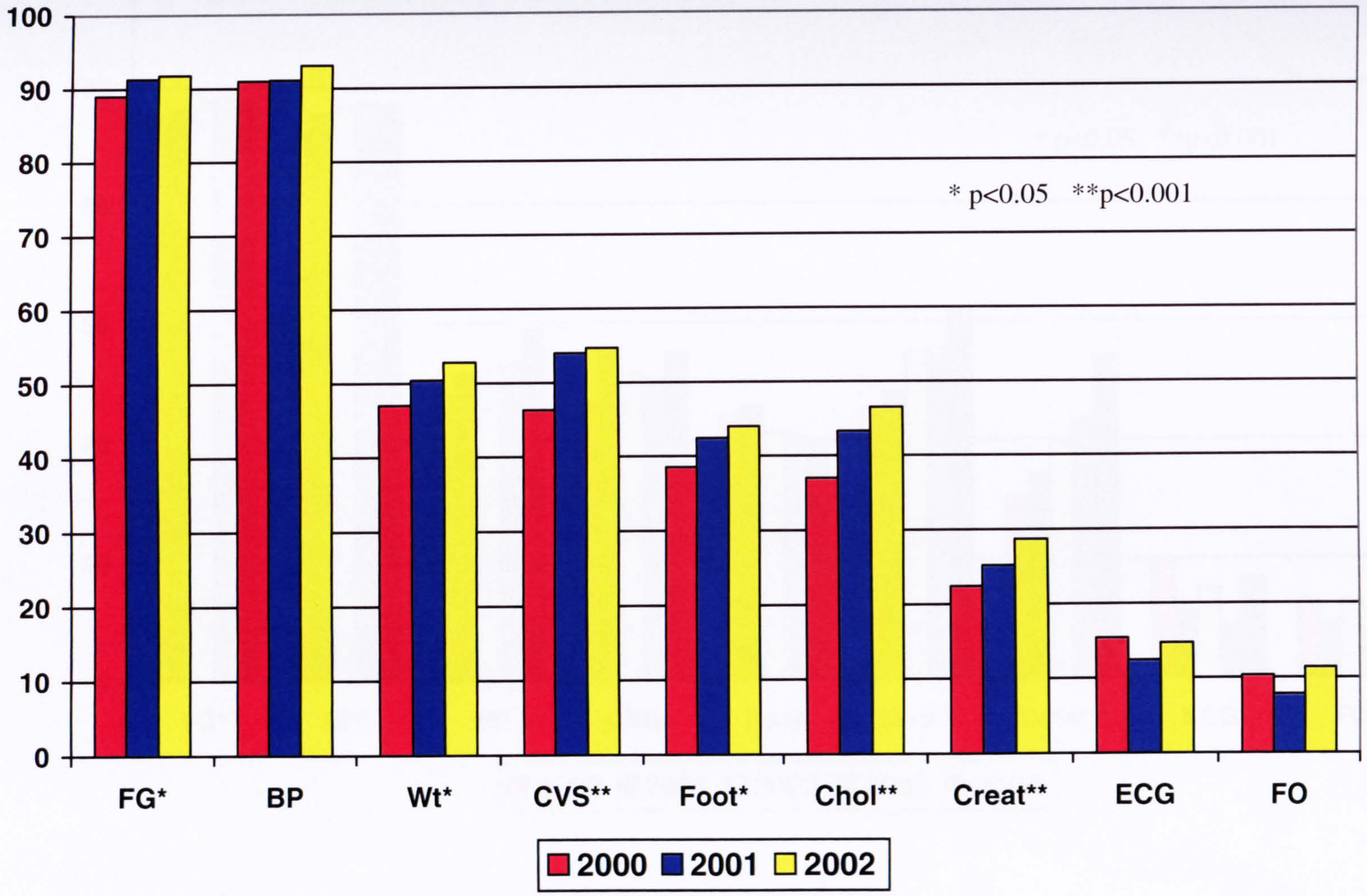
	Number	Mean 2000	Mean 2001	Mean 2002	f statistic	p-value [1]
Fasting glucose (mmol/l)	668	10.35	10.21	10.13	5.16	*0.08*
Total cholesterol (mmol/l)	95	5.31	5.37	5.39	0.22	*0.64*
SBP (mmHg)	720	142.05	143.86	142.10	0.01	*0.94*
DBP (mmHg)	720	81.18	82.40	81.83	3.08	*0.08*
BMI (kg/m^2)	207	28.88	28.76	28.36	23.67	*<0.001*
Creatinine (µmol/l) [2]	50	89.25	88.22	101.54	2.82	*0.10*

Table 9.28 Trend of outcomes in the southern cohort, patients with type 2 diabetes only: 2000 to 2004

	Number	Mean 2000	Mean 2001	Mean 2002	Mean 2003	Mean 2004	f statistic	p-value [1]
Fasting glucose (mmol/l)	185	10.47	10.24	10.18	9.82	10.03	4.74	*0.031*
Total cholesterol (mmol/l)	23	5.45	5.41	5.41	5.09	5.29	1.32	*0.26*
SBP (mmHg)	188	143.50	145.17	143.57	142.87	143.63	0.42	*0.52*
DBP (mmHg)	188	80.72	81.17	80.98	79.34	79.96	4.87	*0.028*
BMI (kg/m^2)	56	30.59	30.78	30.23	30.33	30.12	7.72	*0.007*
Creatinine (µmol/l) [2]	18	93.56	94.09	105.10	90.82	98.43	0.16	*0.69*

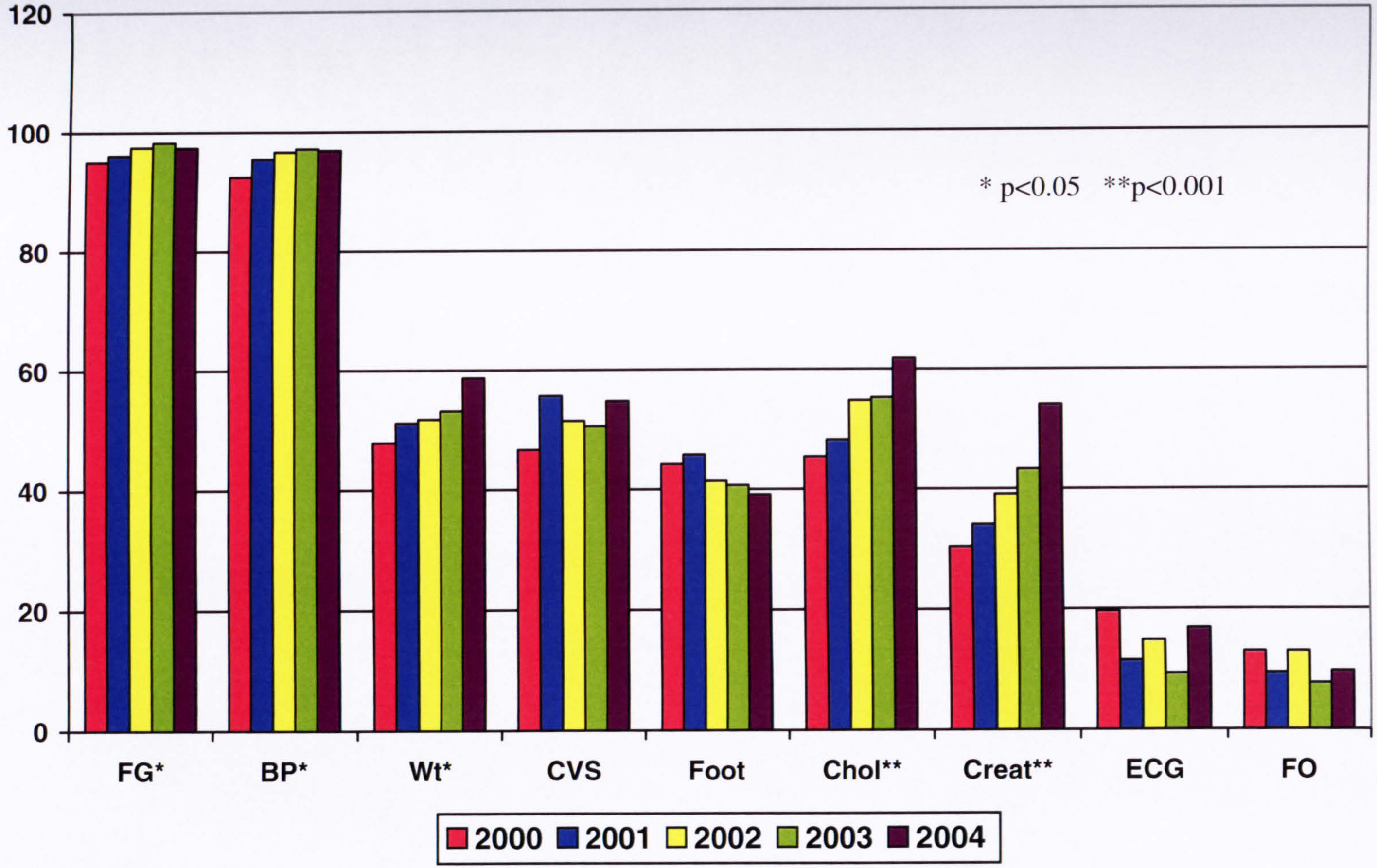
[1] ANOVA test for repeated measures
[2] logarithmic transformation made
SBP: Systolic blood pressure, DBP: Diastolic blood pressure, BMI: Body mass index

Figure 9.8 Process measure carried out each year (%) in the national cohort: 2000 to 2002, patients with type 2 diabetes only



FG: Fasting glucose, BP: Blood pressure, Wt: Weight, CVS: Cardiovascular examination, ECG: Electrocardiogram, FO: Fundoscopy

Figure 9.9 Process measure carried out each year (%) in the southern cohort: 2000 to 2004, patients with type 2 diabetes only



FG: Fasting glucose, BP: Blood pressure, Wt: Weight, CVS: Cardiovascular examination, ECG: Electrocardiogram, FO: Fundoscopy

Appendix 10.1: Full multivariate linear regression models for all fifteen quality indicators

In the following 15 tables, only those explanatory variables associated ($p<0.15$) with the outcome variable in question are shown. Explanations of all explanatory variables are given in Tables 4.1 – 4.3.

Table 10.11 Analysis of explanatory variables against NWPOC (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Type 1 diabetes	0.036	0.003	0.92	-0.03 (-7.50 - 6.85)
Family history of diabetes	0.062	0.23		
Schooling level (average score)	0.132	0.63		
Schooling level (% Level 0)[1]	0.110			
Punctuality of attendance	0.004	0.071	0.73	0.10 (-0.08 – 0.06)
Compliance with treatment	0.022	0.46		
Health Professional				
Motivation of doctors	0.001	0.001	0.059	0.55 (-0.05 – 2.21)
Time commitment of doctors	0.034	0.98		
Organisational				
Development of health centre	0.046	0.35		
Regional affluence	0.097	0.106	0.113	0.51 (0.07 – 0.54)
Presence of DSMR	0.002	0.27		
Presence of chronic disease register	0.007	0.16		
Presence of patient held records	0.052	0.110	0.82	0.05 (-1.45 – 1.78)
Presence of chronic disease clinics	0.001	0.84		
Compliance with chronic disease clinics	0.003	0.032	0.56	0.17 (-0.37 – 0.06)
Equipment: Glucometer present	0.078	0.42		

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record.
ß coefficients (95% confidence intervals) are the results from the final model only.
[1] Schooling level (% level 0) excluded after multilinear regression model showed schooling level (average score) to be more strongly associated with NWPOC.
NWPOC: Non-weighted process of care score is the proportion of 10 measures patients have had undertaken in the preceding 12 months.

Table 10.12 Analysis of explanatory variables against WPOC (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Type of diabetes[1]	0.053			
Family history of diabetes	0.046	0.080	0.096	0.22 (-0.01 – 0.05)
Schooling level (average score)	0.099	0.60		
Schooling level (% Level 0)[2]	0.114			
Poverty (type I)	0.053	0.21		
Insulin treatment	0.145	0.35		
Punctuality of attendance	0.002	0.125	0.91	0.02 (-0.05 – 0.06)
Compliance with treatment	0.033	0.87		
Health professional				
Motivation of doctors	0.001	0.003	0.013	0.37 (0.22 – 1.68)
Time commitment of doctors	0.023	0.72		
Presence of a nutritionist	0.095	0.110	0.72	0.05 (-1.16 – 1.66)
Organisational				
Development of health centre	0.034	0.86		
Regional affluence	0.008	0.098	0.003	0.51 (0.12 – 0.53)
Presence of DSMRs	0.003	0.58		
Presence of chronic disease register	0.004	0.32		
Presence of patient held records	0.049	0.46		
Presence of chronic disease clinics	<0.001	0.078	0.029	0.36 (0.01 – 0.07)
Compliance with chronic disease clinics	0.004	0.79		
Equipment: Glucometer present	0.056	0.96		

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record.
ß coefficients (95% confidence intervals) are the results from the final model only.
[1]Type of diabetes excluded after multilinear regression model showed insulin treatment to be more strongly associated with WPOC.
[2] Schooling level (% level 0) excluded after multilinear regression model showed schooling level (average score) to be more strongly associated with WPOC.
WPOC: The weighted process of care score assigns a weight of 4 to blood pressure and fasting glucose measurements and 1 to the other 8 measures.

Table 10.13 Analysis of explanatory variables against ClinPOC (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Employment	0.114	0.28		
Punctuality of attendance	0.006	0.067	0.51	0.12 (-0.02 – 0.04)
Compliance with treatment	0.010	0.36		
Alcohol consumption	0.097	0.81		
Health professional				
Motivation of doctors	0.003	0.009	0.095	0.29 (-0.07 - 0.84)
Time commitment of doctors	0.024	0.71		
Organisational				
Presence of DSMRs	0.003	0.89		
Presence of chronic disease register	0.010	0.28		
Presence of chronic disease clinics	0.004	0.97		
Compliance with chronic disease clinics	0.002	0.039	0.100	0.33 (0.00 - 0.04)
Equipment: Glucometer present	0.048	0.61		

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record.
ß coefficients (95% confidence intervals) are the results from the final model only.
ClinPOC: Clinical process of care score is the proportion of 4 clinical measures patients have had undertaken in the preceding 12 months.

Table 10.14 Analysis of explanatory variables against POCref (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Age	0.143	0.78		
Type 1 diabetes[1]	0.012			
Family history of diabetes	0.050	0.53		
Schooling level (average score)	0.009	0.034	0.65	0.08 (-0.56 – 0.88)
Schooling level (% Level 0)[2]	0.031			
Poverty (type Is)	0.012	0.21		
Poverty (type I and IIs)[3]	0.092			
Insulin treatment	0.118	0.049	0.48	-0.15 (-0.04 - 0.02)
Punctuality of attendance	0.040	0.048	0.66	0.08 (-0.02 – 0.03)
Health professional				
Motivation of doctors	0.005	0.006	0.145	0.24 (-0.10 – 0.63)
Presence of a nutritionist	0.099	0.21		
Organisational				
Development of health centre	0.007	0.72		
Regional affluence	0.004	0.019	0.045	0.46 (0.00 – 0.24)
Distance to secondary care	0.123	0.19		
Presence of DSMRs	0.019	0.98		
Presence of chronic disease register	0.037	0.35		
Presence of patient held records	0.010	0.42		
Presence of chronic disease clinics	0.002	0.66		
Compliance with chronic disease clinics	0.066	0.136	0.113	0.29 (0.00 – 0.03)

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record.
ß coefficients (95% confidence intervals) are the results from the final model only.
[1] Type 1 diabetes excluded after multilinear regression model showed insulin treatment to be more strongly associated with RefOOC.
[2] Schooling level (% level 0) excluded after multilinear regression model showed schooling level (average score) to be more strongly associated with RefPOC.
[3] Poverty (type 1 and 2) excluded after multilinear regression model showed Poverty (type 1) to be more strongly associated with RefPOC.
RefPOC: Referrals process of care score is the proportion of 6 measures requiring referral, patients have had undertaken in the preceding 12 months.

Table 10.15 Analysis of explanatory variables against 4vOOC (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Age[1]	<0.001	0.98	0.016	- 0.35 (-0.02 – 0.00)
Male gender[1]	0.003	0.78	0.25	0.18 (0.00 – 0.01)
Type 1 diabetes	<0.001	0.90		
Family history of diabetes	0.110	0.92		
Poverty (type Is)	0.145	0.96		
Insulin treatment[2]	0.003			
Associated illness: CVD	0.033	0.54		
Associated illness: Renal disease	0.109	0.99		
Associated illness: Dyslipidaemia	0.014	0.65		
Organisational				
Regional affluence	0.018	0.18		
Size of centre: Total patients	0.033	0.082	0.086	0.23 (-45.1 – 660.1)
Presence of DSMRs	0.055	0.058	0.23	-0.10 (-0.11 - 0.03)
Availability of medication	0.043	0.017	0.039	0.27 (0.00 – 0.06)
Affluence of all patients (type Is)[3]	0.020			
Affluence of all patients (type I & IIs)	0.002	0.20		

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record, CVD: Cardiovascular disease

ß coefficients (95% confidence intervals) are the results from the final model only.

[1]Age and gender included in final model.

[2]Insulin treatment excluded after multilinear regression model showed type 1 diabetes to be more strongly associated with 4vOOC.

[3] Affluence of all patients (type 1) excluded after multilinear regression model showed affluence of all patients (type I and II) to be more strongly associated with 4vOOC.

4vOOC: 4 variables outcome of care score is based on achieving a target for fasting glucose, blood pressure, total cholesterol and body mass index.

Table 10.16 Analysis of explanatory variables against 2vOOC (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Age	0.030	0.73		
Family history of diabetes	0.110	0.96		
Distance reside from health centre	0.143	0.35		
Associated illness: CVD	0.104	0.36		
Associated illness: Dyslipidaemia	0.053	0.056	0.65	0.20 (-0.65 - 0.98)
Health professional				
Number of doctors	0.141	0.102	0.74	-0.14 (-0.08 - 0.06)
Presence of a nutritionist	0.077	0.061	0.89	-0.07 (-0.28 – 0.25)
Organisational				
Development of health centre	0.113	0.120	0.36	-0.43 (-0.09 - 0.04)
Presence of DSMRs	0.109	0.082	0.68	-0.16 (-0.27 - 0.18)
Completion of DSMRs	0.100	0.148	0.52	-0.33 (-0.05 – 0.03)
Presence of patient education sessions	0.056	0.090	0.48	-0.28 (-0.21 – 0.11)

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record, CVD: Cardiovascular disease
ß coefficients (95% confidence intervals) are the results from the final model only.
2vOOC: 2 variable outcome of care is based on achieving low and high targets for blood pressure and fasting glucose only.

Table 10.17 Analysis of explanatory variables against mean glucose levels (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Schooling level (average score)	0.126	0.111	0.030	-0.35 (-0.02 – 0.0)
Poverty (type I and IIs)	0.070	0.53		
Non-attendance	0.040	0.16		
Frequency of attendance	0.141	0.93		
Associated illness: Renal disease	0.124	0.68		
Health professional				
Motivation of doctors	0.003		0.121	-0.23 (-0.51 – 0.06)
Organisation				
Regional affluence	0.046	0.68		
Distance to secondary care	0.080	0.087	0.018	-0.35 (-0.27 - -0.03)
Affluence of all patients (type I & IIs)	0.060	0.38		
Equipment: Electrocardiogram	0.072	0.77		

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record.
ß coefficients (95% confidence intervals) are the results from the final model only.

Table 10.18 Analysis of explanatory variables against mean systolic blood pressure (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Age	0.001	0.053	0.002	0.39 (0.24 – 0.97)
Frequency of appointments	0.117	0.43		
Punctuality of attendance	0.139	0.24		
Smoking habit	0.135	0.40		
Associated illness: CVD	0.085	0.97		
Associated illness: Dyslipidaemia	0.079	0.61		
Health professional				
Number of doctors	0.019	0.003	0.005	0.45 (0.82 – 4.02)
Nutritionist present	0.079	0.038	0.84	0.02 (-3.21 – 3.95)
Organisational				
Development of health centre	0.047	0.140	0.16	0.21 (-0.40 - 2.28)
Presence of DSMRs	0.140	0.061	0.028	0.26 (0.57 – 9.30)
Compliance with chronic disease clinics	0.106	0.56		
Equipment: Glucometer presence	0.097	0.28		
Presence of patient education sessions	0.020	0.032	0.61	0.06 (-2.12 – 3.55)

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record, CVD: Cardiovascular disease.
ß coefficients (95% confidence intervals) are the results from the final model only.

Table 10.19 Analysis of explanatory variables against mean diastolic blood pressure (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Poverty (type I and IIs)	0.110	0.58		
Frequency of appointments	0.132	0.24		
Associated illness: Renal disease	0.122	0.083	0.35	-0.22 (-20.6 – 7.8)
Health professional				
Gender of doctors (female)	0.069		0.55	0.17 (-2.14 – 3.87)
Organisational				
Frequency of clinics	0.125	0.099	0.27	0.33 (-1.57 – 5.24)
Presence of patient held records	0.054	0.31		
Availability of medication	0.056	0.019	0.42	-0.16 (-2.79 – 1.21)
Equipment: glucometer presence	0.086	0.103	0.35	0.20 (-4.14 – 11.12)
Presence of patient education sessions	0.031	0.25		

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, CVD: Cardiovascular disease.
ß coefficients (95% confidence intervals) are the results from the final model only.

Table 10.20 Analysis of explanatory variables against mean cholesterol level (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Age	0.002	0.30		
Male gender	<0.001	0.066	0.001	0.41 (0.01 – 0.02)
Type 1 diabetes	0.015	0.51		
Poverty (type Is)	0.108	0.38		
[1]Poverty (type I and IIs)	0.083			
Insulin treatment	<0.001	0.24		
Associated illness: CVD	0.047	0.33		
Associated illness: Renal disease	0.075	0.54		
Health professional				
Motivation of doctors	0.079	0.60		
Workload of doctors	0.131	0.30		
Organisational				
Distance to Tunis	0.057	0.29		
Regional affluence	<0.001	0.76		
Distance to secondary care	<0.001	0.018	<0.001	-0.43 (-0.16 - -0.05)
Presence of DSMRs	0.121	0.23		
Availability of medication	0.023	0.16		
[2]Affluence of all patients (type Is)	0.002			
Affluence of all patients (type I & IIs)	<0.001	0.21		
Equipment: Electrocardiogram	0.010	0.68		

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record, CVD: Cardiovascular disease.
ß coefficients (95% confidence intervals) are the results from the final model only.
[1] Poverty (type I and IIs) excluded after multilinear regression model showed poverty (type Is) to be more strongly associated with mean cholesterol levels.
[2] Affluence of all patients (type 1) excluded after multilinear regression model showed affluence of all patients (type I and IIs) to be more strongly associated with mean cholesterol levels.

Table 10.21 Analysis of explanatory variables against therapeutic intervention of blood pressure (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Age	0.001	0.14		
Female gender	0.003	0.67		
Type 1 diabetes	0.027	0.092	0.100	-0.42 (-50.9 – 4.97)
Distance reside from health centre	0.031	0.110	0.16	-0.28 (-10.4 – 1.82)
Insulin treatment	0.029	0.90		
Associated illness: CVD	0.071	0.17		
Associated illness: Renal disease	0.066	0.32		
Health Professional				
Workload of doctors	0.074		0.93	-0.02 (-0.25 – 0.23)
Organisational				
Regional affluence	0.076	0.73		
Proportion of patients with diabetes	0.056	0.77		
Availability of medication	0.095	0.89		
Affluence of all patients (type I & IIs)	0.102	0.49		
Equipment: Electrocardiogram	0.030	0.13	0.74	-0.08 (-8.45 – 6.11)
Equipment: Height measurer	0.018	0.013	0.16	0.32 (-2.82 – 15.7)

UVA: Univariate analysis, MVA: Multivariate analysis, CI: confidence interval, CVD: Cardiovascular disease.
ß coefficients (95% confidence intervals) are the results from the final model only.

Table 10.22 Analysis of explanatory variables against therapeutic intervention of fasting glucose (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Family history of diabetes	0.142	0.13	0.18	0.22 (-0.04 – 0.19)
[1]Schooling level (average score)	0.086			
Schooling level (% Level 0)	0.021	0.008	0.016	0.46 (0.02 - 0.19)
Compliance with treatment	0.050	0.56		
Alcohol consumption	0.046	0.091	0.106	0.27 (-2.92 – 27.6)
Health Professional				
Training of doctors	0.028	0.026	0.43	-0.14 (-3.64 – 1.63)
Gender of doctors (female)	0.054	0.086	0.115	0.28 (-0.61 to 5.10)
Motivation of doctors	0.006	0.129	0.077	0.32 (-0.29 – 5.14)
Number of nurses	0.135	0.16		
Organisational				
Milieu of health centre (rural)	0.090	0.073	0.77	0.06 (-4.48 – 5.92)
Distance to secondary care	0.123	0.120	0.23	0.21 (-0.44 – 1.71)

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, ß coefficients (95% confidence intervals) are the results from the final model only.
[1] Schooling level (average score) excluded after multilinear regression model showed schooling level (% level 0) to be more strongly associated with TI-FG.

Table 10.23 Analysis of explanatory variables against ACE Inhibitor prescribing (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Female gender	0.002	0.23		
Type 1 diabetes	0.130	0.51		
[1]Schooling level (average score)	0.105			
Schooling level (% Level 0)	0.073	0.91		
Insulin treatment	0.021	0.18		
Non-attendance	0.068	0.47		
Frequency of attendance	0.079	0.56		
Punctuality of attendance	0.118	0.075	0.031	0.29 (0.05 - 0.93)
Health Professional				
Interest in diabetes of doctors	0.045	0.029	0.065	-0.24 (-36.5 – 1.21)
Training of doctors	0.008	0.033	0.016	-0.32 (-15.5 - -1.77)
Motivation of doctors	0.070	0.44		
Number of nurses	0.037	0.135	0.082	0.23 (-0.20 – 3.13)
Organisational				
Development of centre	0.012	0.68		
Frequency of clinics	0.037	0.58		
Distance to Tunis	<0.001	0.16		
Regional affluence	0.128	0.19		
Distance to secondary care	0.121	0.34		
Size of centre: Patients with diabetes	0.070	0.54		
Proportion of patients with diabetes	0.006	0.20		
Affluence of all patients (type Is)	0.044	0.13	0.058	0.25 (-0.02 – 1.30)
[2]Affluence of all patients (type I & IIs)	0.140			
Equipment: Electrocardiogram	0.035	0.44		

UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval.
ß coefficients (95% confidence intervals) are the results from the final model only.
Odds Ratio (95% CI) are the results from the final model only.
[1] Schooling level (average score) excluded after multilinear regression model showed schooling level (% level 0) to be more strongly associated with ACE-I use.
[2]Affluence of all patients (type 1 & 2) excluded after multilinear regression model showed affluence of all patients (type 1) to be more strongly associated with ACE-I use.

Table 10.24 Analysis of explanatory variables against BP prescribing (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Duration of diabetes	0.047	0.090	0.53	-0.20 (-5.84 – 3.16)
Non-attendance	0.123	0.69		
Frequency of attendance	<0.001	0.98		
[1]Frequency of appointments	0.033			
Associated illness: Renal disease	0.060	0.071	0.705	-0.10 (-58.1 – 40.0)
Associated illness: Dyslipidaemia	0.120	0.19		
Health Professional				
Training of doctors	0.026		0.64	-0.15 (-11.0 – 7.01)
Organisational				
Completion of DSMRs	0.017	0.96		
Equipment: Electrocardiogram	0.055	0.19		
Presence of patient education sessions	0.002	0.004	0.026	0.56 (1.80 – 23.78)

BP: Blood pressure, UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval, DSMR: Disease-specific medical record, CVD: Cardiovascular disease.
ß coefficients (95% confidence intervals) are the results from the final model only.
[1]Frequency of appointments excluded after multilinear regression model showed frequency of attendance to be more strongly associated with TI-BP.

Table 10.25 Analysis of explanatory variables LLM prescribing (p-values shown)

Explanatory variable	UVA	Intermediate MVA	Final MVA	ß coefficient (95% CI)
Patient				
Family history of diabetes	0.011	0.019	0.015	0.37 (0.13 – 1.10)
Smoking habit	0.121	0.22		
Health Professional				
Motivation of doctors	0.009	0.70		
Time commitment of doctors	0.016	0.084	0.012	0.38 (4.03 – 30.5)
Organisational				
Milieu of health centre (rural)	0.056	0.24		
Development of health centre	0.112	0.76		
Distance to secondary care	0.053	0.27		
Equipment: Electrocardiogram	0.065	0.62		

LLM: lipid-lowering medication, UVA: Univariate analysis, MVA: Multivariate analysis, CI: Confidence interval
ß coefficients (95% confidence intervals) are the results from the final model only.

Appendix 12.1: Recommendations offered to the Tunisian Ministry of Health

Recommandations

Il apparaît par ailleurs que l'amélioration de la qualité de PEC a commencé dès la mise en place du programme national de PEC des diabétiques et des hypertendus.

Dans ce cadre, nous proposons quelques suggestions

1- Nous avons constaté une majorité féminine dans les CSB, bien que la prévalence du diabète soit comparable dans les deux sexes. C'est pourquoi il est recommandé d'agir pour rendre les CSB plus accessibles aux hommes.

2- La motivation des médecins est un facteur important dans l'amélioration de la qualité de PEC. C'est pourquoi il est recommandé de reconnaître les différents aspects de cette motivation et prendre les mesures appropriées pour mieux impliquer les médecins de santé publique dans ce programme.

3- Il est démontré que l'existence d'une journée de consultation réservée pour les chroniques dans le CSB améliore la qualité de leur PEC. C'est pourquoi il est recommandé de la généraliser dans tous les CSB ayant une activité de consultation médicale de 4 ou 5 ou 6 jours par semaine.

4- L'utilisation du nouveau dossier médical spécifique aux malades chroniques a aussi permi l'amélioration de la qualité de leur PEC. Il est donc recommandé de fournir ce dossier à tous les CSB. Il est aussi recommandé au personnel médical de le remplir correctement.

5- Le facteur socio-économique intervient dans la qualité de PEC, c'est pourquoi il faudrait intensifier l'éducation des patients et mieux assister les CSB dans les régions défavorisées.

6- Généraliser l'éducation des patients dans tous les CSB car c'est un facteur important de bonne observance et de bonne PEC.

7- La présence de nutritionniste dans le CSB le jour de la consultation des chroniques est un facteur de bonne qualité de PEC.

8- Encourager et généraliser l'initiative de plusieurs régions en prenant comme priorité la disponibilité des médicaments des chroniques.

9- L'idéal, serait de faire une étude dans les CSB en s'inspirant des résultats de la présente étude pour tester les éventuelles actions à faire afin d'améliorer la qualité de PEC des patients diabétiques.

Appendix 12.2: Publications

a) Alberti H. "Sokkor": Research into the contextual facilitators and barriers involved in the management of patients with type 2 diabetes mellitus must now intensify and extend into all cultures worldwide (Letter). *Fam Pract* 2003;20:94.

b) Alberti H, Boudriga N, Nabli M. Primary Care in Tunisia: improving diabetes management. *Diabetes Voice* 2003;48:21-23.

c) Alberti H, Boudriga N, Nabli M. Variations in care of diabetes in primary care centres in Tunis. *Diabetes Metab* 2004;30:197-200.

d) Alberti H. Barriers and facilitators to care in the management of type 2 diabetes mellitus. *Africa Health* 2004;1:9-11.

e) Alberti H, Boudriga N, Nabli M. The factors affecting the quality of diabetes care in primary health care centres in Tunis. *Diabetes Res Clin Pract* 2005;68:237-43.

f) Alberti H, Boudriga N, Nabli M. Disease-specific medical records improve the recording of processes of care in the management of Type 2 diabetes mellitus. *Public Health* 2006;120:650-653.

g) Alberti H. Sex inequalities (Letter). *Br J Gen Pract* 2006;56:628

h) Alberti H, Boudriga N, Nabli M. Improvements in quality of care of patients with diabetes in primary care in Tunisia. *Pract Diab Int* 2007;24:152-157.

i) Alberti H, Boudriga N, Nabli M. "Damm Sokkor" Factors associated with the quality of care of patients with diabetes: A study in primary care in Tunisia. *Diabetes Care published online 10.2337/dc07-0520.*

As Marteau *et al.*, we agree that future health promotion interventions are needed not only with adults but also with teenagers.

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References

[1] Marteau TM, Hankins M, Collins B. Perceptions of risk of cervical cancer and attitudes towards cervical screening: a comparison of smokers and non-smokers. *Fam Pract* 2002; 19: 18–21.

'Sokkor': research into the contextual facilitators and barriers involved in the management of patients with type 2 diabetes mellitus must now intensify and extend into all cultures worldwide

The paper by Brown *et al.*[1] is an important insight into the contextual facilitators and barriers involved in the management of patients with type 2 diabetes mellitus. Research into this often neglected area must now intensify and extend into all cultures worldwide.

In Tunisia, the number of patients with diabetes has more than doubled in the last two decades.[2,3] We currently are undertaking a study exploring the factors that affect the management of patients with diabetes in primary care in the public sector in Tunis. From a variety of sources (medical records, formal interviews, discussions, observation and reflection), we have discovered >80 potential facilitators and barriers to care, and, like Brown *et al.* suggest, many of these factors interact closely with one another.

The most frequently noted factors are availability of specialists, laboratory facilities and medical supplies, the quality of the medical files used, the motivation of the physicians, and patient adherence. Many of these factors have been noted in previous studies in the western world, but a number of additional factors also appear to be important and warrant further study: (i) the patients understanding of 'sokkor' ('diabetes', literally translated as 'sugar') and their use of traditional healers; (ii) the availability and performance of medical supplies and equipment; (iii) the motivation of other health centre staff, as well as the physician; and (iv) the 'culture' and underlying philosophy of each individual health centre.

Further exploration of the factors that prevent effective implementation of chronic disease management guidelines in primary care around the world is crucial:

> "(when I talked to the doctors) they often blamed poor care on the patients by saying that the patients were uncompliant, especially with diets, but never explored why they were or what they could do about it" (quote from a non-medically trained, Tunisian researcher).

References

[1] Brown BB, Harris SB, Webster-Bogaert S, Wetmore S, Faulds C, Stewart M. The role of patient, physician and systemic factors in the management of type 2 diabetes mellitus. *Fam Pract* 2002; 19: 344–349.
[2] Papoz L, Ben Khalifa F, Eschwege E, Ben Ayed H. Diabetes mellitus in Tunisia: description in urban and rural populations. *Int J Epidemiol* 1988; 17: 419–422.
[3] Institut National de Nutrition. *Evaluation de l'etat Nutrionnel de la Population Tunisiene*. Tunis: Enquete Nationale, 1996–1997.

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Primary care in Tunisia: improving *diabetes management*

Hugh Alberti, Nessiba Boudriga, Mounira Nabli

Tunisia, like most countries of the world, is experiencing an alarming rise in the number of people with diabetes: the prevalence of Type 2 diabetes in adults over 30 year of age rose from 4.2% in 1976 to 10% in 1995. In response, the Tunisian Ministry of Public Health have developed a National Programme of diabetes and high blood pressure (hypertension) management in primary care. Initially introduced in 1993, the Programme was then implemented throughout the country in 1998.

>>

The ultimate goal of the Programme is to reduce the impact on health of diabetes complications. To achieve this goal, good quality, regular standardized care for people with diabetes must be ensured. The four intermediate objectives are:

- the prevention of the risk factors for developing diabetes
- the screening of people at risk of developing diabetes
- the provision of regular care for people with diabetes
- the provision of health education for people with diabetes and their families, and the general population.

Strategy

In terms of strategic planning, the four key areas of the National Programme are health education, evaluation, supervision, and training.

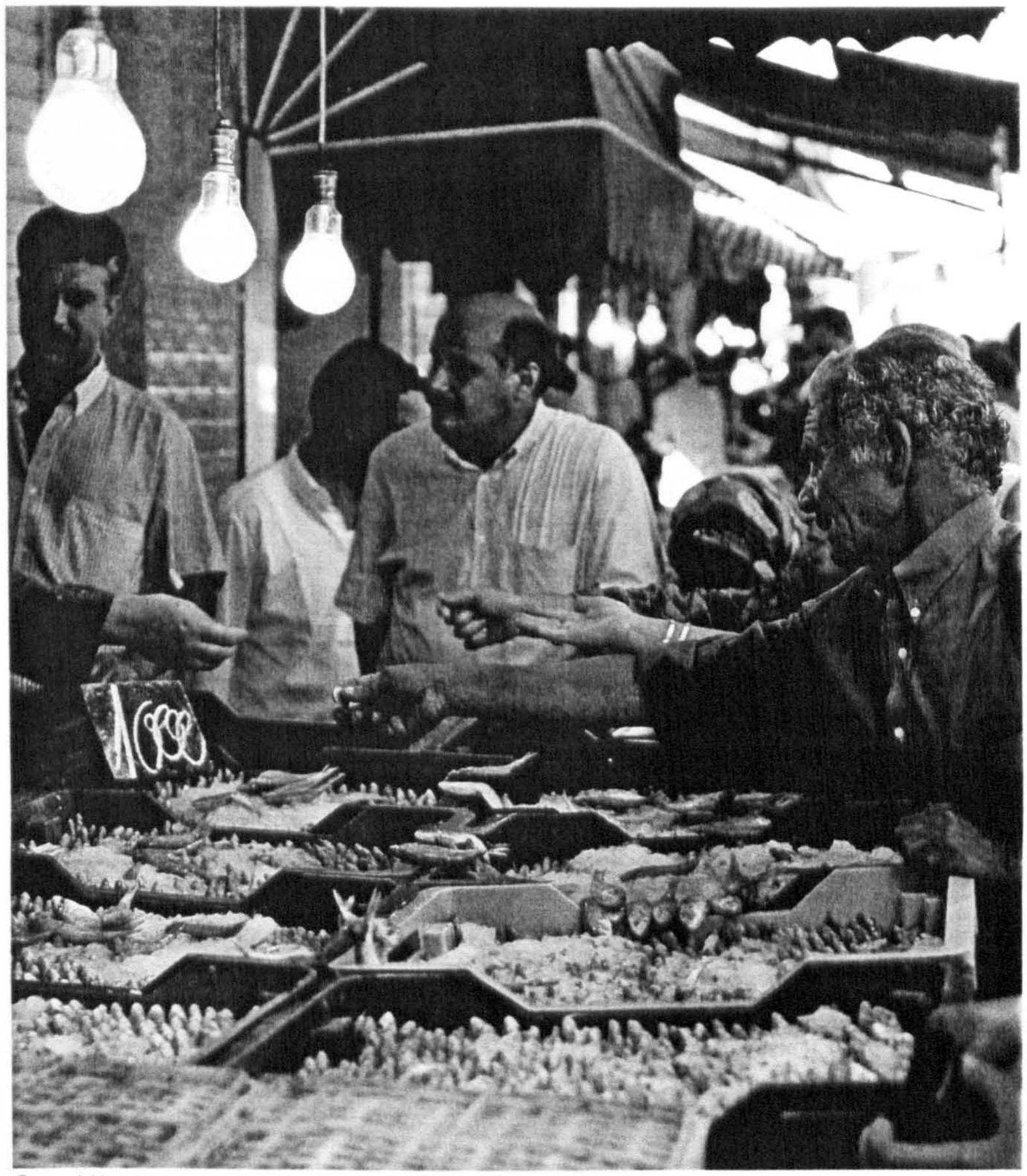
Health education

The strategy of the Programme is based primarily on health education. This includes the use of the media in publicity campaigns, the production and distribution of educational materials, and the education of people with diabetes, individually and in groups, at their local primary health-care centre.

To reduce the impact of diabetes complications, good quality, regular standardized care must be ensured.

Evaluation

Regional annual reports evaluate the effectiveness of the Programme. These include data on the total number of cases (prevalence) and the frequency of occurrence (incidence) of diabetes and its complications, the number of people with diabetes who are involved in the Programme, and the number of non-attendees. >>



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Supervision

This is achieved at the central level by a National Supervisor, and at the local level by Regional Co-ordinators. Their responsibilities include:

- ensuring that the National Programme is being implemented in health centres
- collecting information for the annual reports
- organizing the teaching programme for the primary care doctors.

Training

A one-week training course is offered to health-care professionals at various centres around the country. This includes theoretical aspects of diabetes and its complications, and practical instruction in the use of new documentation. This documentation includes new records for people with diabetes and hypertension, a register of all people with these conditions, and diabetes management records kept by people with diabetes. The primary care physicians are then given responsibility for the training of paramedical staff at their health centres.

Further evaluation

Structured questionnaires, which are completed by the primary health-care professionals at local level are used to further evaluate the Programme. Quantitative analysis of the annual reports is being carried out, and a random selection of health centres are being visited in order to review records, and interview staff and people with diabetes.

Results of evaluation

Although evaluation of the National Programme is still in its initial stages, a number of findings have been instructive and are being incorporated into the Programme. For example, analysis of over 500 individual health records has demonstrated that their use is associated with the improved recording of data and results of investigations.

> The strategy of the Tunisian Programme is based primarily on health education.

A second example concerns eye examinations. At present, these are only performed by eye specialists based at hospitals. The number of people with diabetes who have an annual eye examination was found to be low. A number of reasons for this have been identified through discussion with the carers involved in the Programme at local level. The explanations offered included the long distances some people have to travel to reach their local hospital, and the excessive waiting time to see a specialist at some hospitals. In response, primary care doctors in one large region of the country are being trained to carry out eye examinations, and the extension of this approach to other areas is being discussed.

A third issue that has been highlighted through the experience of primary care doctors is that of communication between primary and secondary care. Previously, primary care doctors rarely received information or results regarding the people that they had referred to secondary or tertiary care. In order to improve the flow of information, a new referral form has been designed, with input from primary and secondary care physicians. This allows for the secondary care doctors to report back the results of any investigations.

> The screening of people with IGT, and health education on lifestyle issues are currently being incorporated into the Programme.

Lastly, the introduction of a *consultation individualisée* (special clinic) at many of the primary care centres has potentially improved the quality of care of people with diabetes. One day a week, people with diabetes and hypertension are given priority in these centres. The primary care team works together to provide education and care: a dietician is available to provide individual and group education, and nurses perform urine tests, and random blood sugar (glucose) tests with glucometers which have been provided as part of the National Programme.

The Future

Although in its early stages, the National Programme seems to be improving the management of diabetes in primary care in Tunisia. As research findings highlight new areas for concern, the Programme must remain flexible and open to new input. The screening of people with impaired glucose tolerance (IGT) is one of the new ideas that is being incorporated into the Programme. Health education on lifestyle issues is another. Some other advances are currently beyond the financial resources of the Programme. However, innovations such as the use of digital retinal cameras may form future goals.

There is, of course, much to be done to achieve the objectives of the Programme; but progress is being made. The Programme is potentially a model for care in other countries with limited resources and growing numbers of people with diabetes.

Hugh Alberti, Nessiba Boudriga, Mounira Nabli

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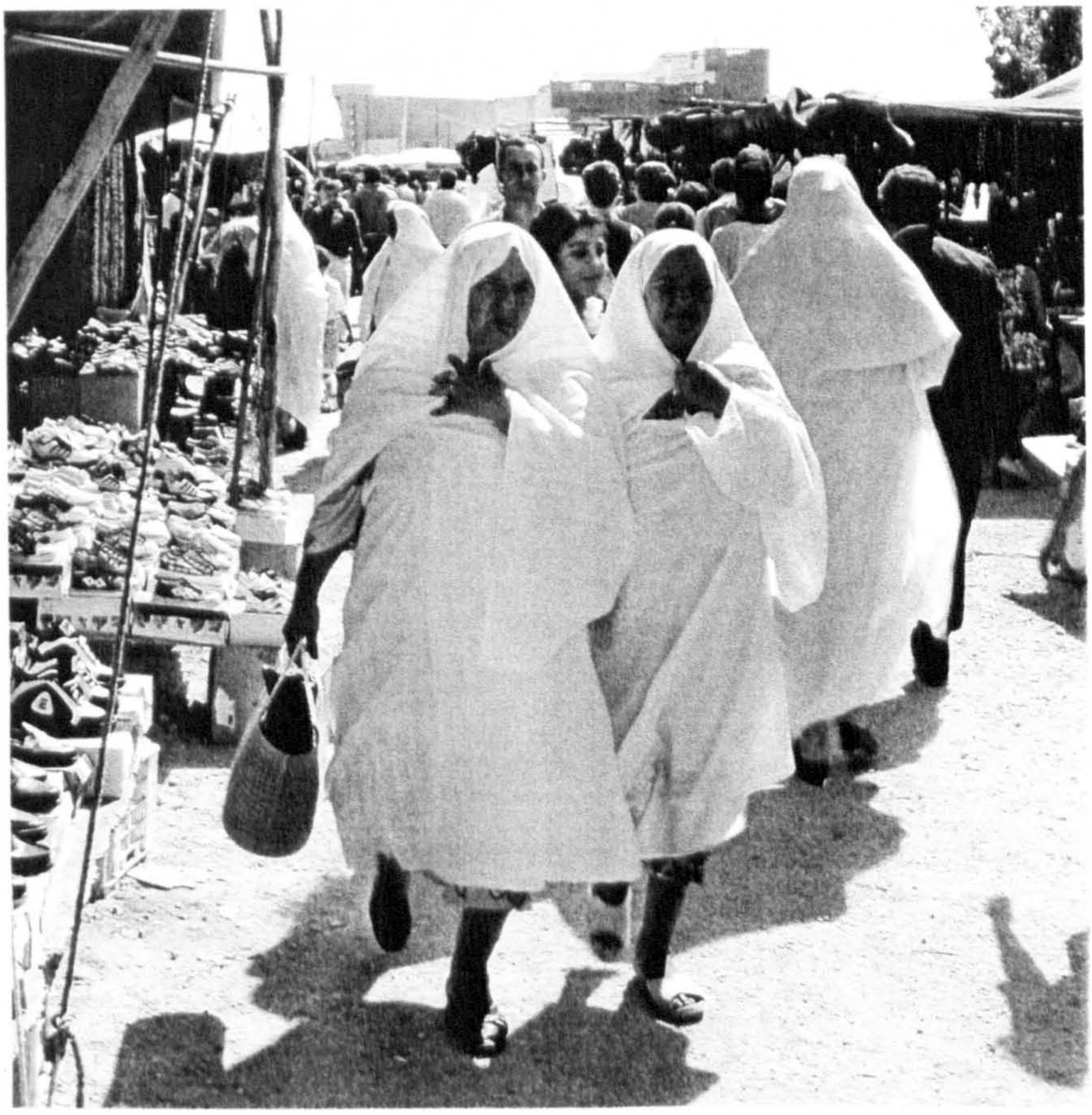

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Variations in care of diabetes in primary care centres in Tunis

HP Alberti, N Boudriga, M Nabli

SUMMARY

The aim of this study was to investigate the care of diabetes in primary care in the public sector in Greater Tunis and in particular, to assess variations in care across centres with the intention of seeking explanations for any differences identified. We undertook a retrospective medical review of patients with diabetes from four primary care health centres. Data were collected concerning patient characteristics, process of care criteria, outcome of care criteria, attendance rates, treatment and health centre characteristics.

The total sample size was 235 patients. Outcome of care criteria were found to be similar across each of the centres. Process of care criteria were found to be significantly varied between the centres for all measurements used. Variations were also found in treatment and attendance rates across the health centres. In conclusion, there is a significant variation in the management of diabetes in primary care across centres within Greater Tunis, despite the use of standardised, national guidelines. A number of factors related to the centres may have given rise to these variations.

Key-words: Diabetes · Quality of care · Management.

Alberti HP, Boudriga N, Nabli M. Variations in care of diabetes in primary care centres in Tunis
Diabetes Metab 2004,30,197-200

RÉSUMÉ

Variations dans la prise en charge des diabétiques dans les centres de santé de base de Tunis

L'objectif de notre travail consiste à évaluer la prise en charge des diabétiques dans les centres de soins de santé de base dans le grand Tunis. Nous essayerons à travers cette etude rétrospective de ressortir les éventuelles causes de variations dans la qualité de suivi des patients diabétiques d'un centre à l'autre parmi les centres pré-cités. Nous avons relevé du dossier médical des chroniques les données portant sur l'identité des patients, la qualité de leur prise en charge sur le plan clinique, biologique et thérapeutique ainsi que l'existence d'éventuels défaillants.

Dans notre échantillon, composé de 235 patients, nous avons relevé une différence significative dans les différents paramètres de suivi des diabétiques, dans le nombre de défaillants et dans la prescription thérapeutique d'un centre de soins à l'autre. En conclusion, il est intéressant de noter que malgré l'existence d'un programme national de prise en charge des diabétiques et des hypertendus dans les structures de première ligne, il existe différents facteurs de variations de la qualité de la prise en charge qui dépendent du personnel soignant, du patient et de l'emplacement du centre de soins.

Mots-clés : Diabète · Qualité de soin · Prise en Charge.

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Tunisia, like most countries around the world, is experiencing a major increase in non-communicable diseases such as diabetes. A doubling of the number of people with diabetes has been reported since the 1980s [1] and a recent survey in the country suggested that in the capital, Tunis, 10% of adults now have diabetes mellitus [2]. A large proportion of patients with diabetes in Tunisia are managed in primary care centres within the public sector. In the 1990s the Tunisian Ministry of Health instituted a national programme of hypertension and diabetes management within primary care. The programme incorporates teaching of primary health care doctors and the use of national, standardised protocols, medical dossiers and registers. However, the process of care of patients with diabetes is complex. To improve quality of care, information is needed about the variables that influence care and the obstacles faced in improving care.

A study was therefore conducted to investigate the care of diabetes in primary care in the public sector in Tunis. In particular, variations in care across centres were to be assessed with the intention of seeking explanations for any differences identified.

Patients and methods

Approval for the study was granted by the Tunisian Ministry of Public Health. One health centre from each of the four regions of Greater Tunis was selected and visited on a number of occasions. The selection was made by each regional co-ordinator of the national program and in three of the four cases, the centre in which the co-ordinator worked was selected. A random sample comprising at least 25% of the patients with diabetes managed at each centre was collected and the medical dossiers studied. Data were collected from the subjects clinical records concerning the patient (age, gender, socio-economic status); process of care criteria (records of weight, blood pressure, fasting glucose, cholesterol, creatinine, glycosylated haemoglobin (HbA_{1c}), fundoscopy, ECG, foot examination and cardiovascular examination); outcome of care criteria (results of BMI, blood pressure, fasting glucose, cholesterol and creatinine); attendance rates; treatment; and health centre characteristics. Criteria for process of care measurements were based on the guidelines within the national program.

Descriptive analysis was performed using 2 by 2 tables for comparison of proportions and analysis of variance (or Kruskal-Wallis if data was not normally distributed) for comparison of means.

Results

A sample of between 25% and 50% of diabetic medical dossiers was taken from each centre comprising a total of 235 patients. The mean age of patients was 60.2 years (range 25-93), the majority were female (71.5%) and almost all had type 2 diabetes (96.2%).

Two health centres had significantly younger patients than the other two ($p < 0.01$), but there was no significant variation in the proportion of women across the centres. Socio-economic status was assessed using occupation, patient's level of schooling and health insurance coverage at each centre. All three measurements were significantly varied across the centres.

Process of care criteria were based on the proportion of patients who had each measurement documented in the 12 months preceding the study visit. *Figure 1* demonstrates that all process of care measurements varied widely ($p < 0.05$ for all measurements) between the centres.

Centre 4 has strikingly lower rates of processes of care, although there remains a significant variation across the other three centres. In contrast, there was no significant difference in process of care criteria between men and women.

Outcome of care criteria were based on the last measurement recorded in the medical notes. The mean blood pressure was 139/83 mmHg (with a range of mean blood pressure results across the centres of 132-149/80-86); BMI 28.7 (range 27.3-29.5); cholesterol 5.2 mmol/l (range 4.8-5.4); creatinine 79.3 µmmol/l (range 76.8-84.2); fasting glucose 10.6 mmol/l (range 9.4-10.9). HbA_{1c} results were excluded because of the low number recorded. The only significant variation found was systolic blood pressure; BMI, cholesterol, creatinine, fasting glucose and diastolic blood pressure were all found to be similar across the centres. When men and women were compared, women were found to have a significantly higher BMI and lower creatinine; the other measurements were found to be similar.

The attendance rates and treatment used at each centre are listed in *Table I*. The only oral medications used at the centres were glibenclamide and metformin, as mono or dual therapy. Significant variations were found in the proportion of patients on diet only and those on dual therapy. Characteristics of the health centres are listed in *Table II*. The rural centre (centre 2) was found to have a much higher number of consultations per doctor, and the patients had to travel a greater difference to the nearest hospital (for fundoscopy and ECG measurements) and laboratory (for blood tests). Within the national program doctors are offered extra training in diabetes and hypertension management and the number of those who had attended this training is noted in *Table II*. Significantly, centre 4 was the only centre in which the corresponding regional co-ordinator of the national program did not work.

Conclusions

In this study we found a significant variation in the management of diabetes in primary care in Greater Tunis, despite the introduction of standardised, national management guidelines and medical dossiers. All process of care measure-

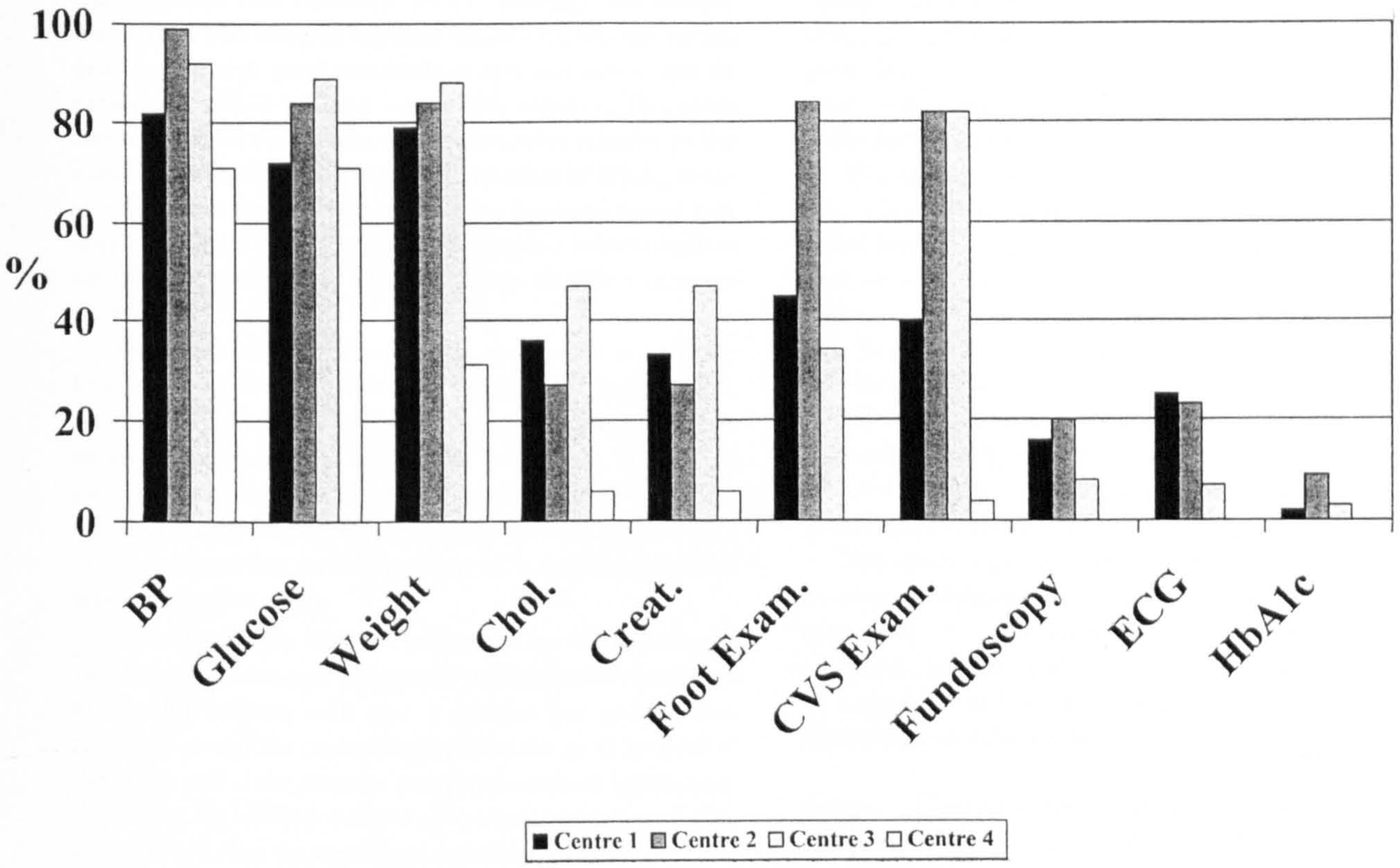

Figure 1
Percentage of patients for whom care was documented in the preceding year.

ments were found to be significantly varied. This variation in care does not appear to have significantly affected the outcome of care measured in the short-term although it is difficult to link measures of process of care and measures of outcome in transversal studies such as this. Studies elsewhere have similarly shown variations in processes but not outcomes [3, 4] and it has been suggested that measuring well supported processes may be more enlightening than monitoring outcomes [5].

Table I
Attendance rates and treatment at the four health centres.

Centre	1	2	3	4
Average number of visits*	3.9	3.6	2.9	3.1
Percentage of defaulters**	13.4	11.4	8.2	15.5
Type of Treatment (percentages)				
Diet alone	15	0	3	2
Oral monotherapy	33	55	53	21
Oral dual therapy	36	36	30	65
Insulin	16	9	14	12

* In the preceding full calendar year.
** A defaulter was a patient who had previously consulted the health centre but had not attended in the preceding 12 months.

It is acknowledged that this study relies on the recording of care and not necessarily the care that was delivered, and that it is not a random sample of centres and thus may not be fully representative of primary care in Greater Tunis. However, it is encouraging to note that the process and outcome of care results compare favourably with published studies

Table II
Characteristics of the four health centres.

Centre	1	2	3	4
Total number of diabetics	264	87	281	130
Number included in the study	67	44	73	51
Location	Urban	Rural	Semi-Urban	Semi-Urban
Consultations per year	12,689	14,081	21,140	13,140
Number of doctors	3	2	6	4
Number of doctors undertaken extra training in diabetes	3	2	2	0
Presence of the regional co-ordinator	Yes	Yes	Yes	No
Functioning Glucometer	Yes	Yes	No	No

from primary care elsewhere [3, 6]. Although this sample may have a bias towards superior health centres, the results demonstrate that good standards of care can potentially be performed within primary care in this country. The main shortcoming of the process of care measures relative to the national guidelines is the very small number of HbA_{1c} measurements performed. However, it has been suggested that where resources are short, glucose testing is a reliable indicator of poor control that can be used to modify treatment safely [7].

The predominance of women in our sample is striking. Discussions with professionals in this country confirm that women do attend the public sector primary care centres more than men, despite the similar prevalence rates. This may be due to men having difficulty taking time off work, health centres being open in the mornings only, or men taking their illness less seriously: this is an important area that warrants further study.

Not surprisingly, very few patients in our study had type 1 diabetes. The national program is predominantly intended to care for patients with type 2 diabetes but patients can choose to attend the centres rather than the local hospital if they wish and if the primary care physician is in agreement. Repeating the analysis without the patients with type 1 diabetes did not alter the significant variations found.

The imperative task is to seek to explain these variations of care between four health centres, all within the same city, and all using standard medical dossiers and guidelines. Previous studies in other geographical locations have suggested a wide range of factors relating to the patient, the health professional and the organisation of care, that may affect the quality of care of patients with diabetes [8, 9]. Our study seems to suggest that the influence of the health centre is a strong determinant of the care received by patients with diabetes in this country. Although the study is too small to calculate statistical correlations, a number of characteristics of the health centres can be suggested as being related to the variations in care observed. It is striking to note that the centre with the poorest levels of recording of care (centre 4) is the centre without a regional co-ordinator and with the lowest number of doctors who had attended training in diabetes. This supports the assumption that training physicians in diabetes improves the process of care of patients with diabetes and has been reported in some [9], but not all studies [3]. There does not appear to be any correlation between location of the centre, the presence of a functioning glucometer or the number of patients seen at the health centres and the process of care. The range of treatment was very similar in all the centres with only two medications and four forms of insulin being used. However, the significant differences in the proportion of patients on diet only and dual therapy suggest that other factors, in addition to the national program guidelines, play a role in determining the patient's treatment. This variation in treatment confirms previous findings that even with appropriate knowledge, clinicians do not always follow guidelines [10]. Centre 4 again shows some differences to the other centres and this may be due to the lack of extra training of the doctors at this centre.

The average number of consultations in the preceding year is high considering the number of defaulters. The national program suggests 3 monthly visits and it seems that most attendees are being seen regularly. The number of defaulters is difficult to interpret as it includes patients who may have decided to attend a private clinic or secondary care for their management, as well as patients who have died or moved area. However, centre 4 has the highest proportion of apparent defaulters and this along with the poorer recording of care may support the hypothesis that this centre is offering poorer quality of care compared to the other three centres.

This study is too small to make definite conclusions but a number of hypotheses have been generated that warrant further study. A fuller understanding of variability of care within the context of the patients cultural environment will be important to improve quality of care of patients with diabetes around the world.

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References

1. Papoz L, Ben Khalifa F, Eschwege E, Ben Ayed H. Diabetes mellitus in Tunisia: Description in urban and rural populations. Int J Epidemiol, 1988, 17, 419-22.
2. Ghannem H, Fredj AH. Epidemiology of hypertension and other cardiovascular disease risk factors in the urban population of Sousse, Tunisia. East Mediterranean Health J, 1997, 3, 472-9.
3. Khunti K, Ganguli S, Baker R, Lowy A. Features of primary care associated with variations in process and outcome of care of people with diabetes. Br J Gen Pract, 2001, 51, 356-60.
4. Arday DR, Fleming BB, Keller DK, *et al.* Variation in diabetes care among states. Diabetes Care, 2002, 25, 2230-7.
5. Davies HTO, Crombie IK. Assessing the quality of care. BMJ, 1995, 311, 766.
6. Dunn N, Pickering R. Does good practice organisation improve the outcome of care for diabetic patients? Br J Gen Pract, 1998, 48, 1237-40.
7. Rotchford AP, Rotchford KM, Machattie T, Gill GV. Assessing diabetic control — reliability of methods available in resource poor settings. Diabetic Med, 2002, 19, 195-200.
8. Brown BB, Harris SB, Webster-Bogaert S, Wetmore S, Faulds C, Stewart M. The role of patient, physician and systemic factors in the management of type 2 diabetes mellitus. Fam Pract, 2002, 19, 344-9.
9. Pringle M, Stewart-Evans C, Coupland C, Williams I, Allison S, Sterland J. Influences on control in diabetes mellitus: patient, doctor, practice or delivery of care? BMJ, 1993, 306, 630-4.
10. Lawler FH, Viviani N. Patient and physician perspectives regarding treatment of diabetes: Compliance with practice guidelines. J of Fam Pract, 1997, 44, 369-73.

Barriers and facilitators to care in the management of type 2 diabetes

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The 21st century is facing a new pandemic: the world's diabetic population has been predicted to double between the years 1995 and 2025 to a total of around 300 million people, with a greater increase expected in Asia and Africa.[1] There is now clear evidence that tight control of blood glucose and blood pressure lowers the risk of microvascular and macrovascular complications in type II diabetes.[2-4] Yet despite this evidence, the quality of care of patients with diabetes worldwide has continually been shown to be variable and suboptimal.[5-10] As newer and stricter guidelines and protocols are produced we, as clinicians, are faced with an ever-increasing gap between the theory and practice of managing our patients: 'Evidence-based guidelines meet the real world,'[11] as one author expressed the current situation of diabetes care. In order to effectively translate research knowledge into improved clinical care, we urgently need information about the barriers and facilitators to care in the management of type 2 diabetes.

Some research has been done in the Western world in attempting to determine the factors that influence quality of care of patients with diabetes. Factors postulated as potential barriers or facilitators to care can be broadly separated into patient, clinician, and organisational factors.

Patient factors

Patient factors thought to influence the process of care can be physical – such as age, sex, length of illness and the type of diabetes and treatment.[12] The effect of gender on quality of care is inconsistent[13,14] and contextual factors may explain the contradictory research findings in this area. Patients' attendance[15,16] at healthcare centres and accessibility of care are important subjects that may be as much due to organisational barriers (such as the distance to the nearest health centre) as patient issues such as motivation or illness awareness.

The complex issue of patient compliance, or adherence, is a crucial issue. A rigorous review by Haynes has found that, in developed countries, adherence among patients suffering chronic diseases averages only 50%.[17] The magnitude and impact of poor adherence in developing countries is assumed to be even greater, given the shortage of health resources and iniquities in access to care. Haynes declared that 'increasing the effectiveness of adherence interventions may have far greater impact on the health of the population than any improvements in specific medical treatments.' Attempts are being made to use terminology such as adherence and concordance, to highlight the importance of patient autonomy and to encourage physicians to be aware of the patient's social and economic constraints.[18,19] Physicians themselves regard, or possibly blame,[20] patient non-adherence to treatment as the most common barrier to diabetes care.[16,21,22] The causes of lack of concordance can be physical, such as poverty or poor health, educational, such as a lack of health knowledge or awareness of the seriousness of their illness, or psychological. A multi-ethnic study from New Zealand[23] postulated ten key areas of personal barriers to care that proved to be consistent across all ethnic groups. Lack of a wide range of community-based services and unsatisfactory education and knowledge of diabetes were frequently reported barriers. However, many of the other barriers were psychological, such as perception of the importance of diabetes, self-motivation, health beliefs, and a sense of disempowerment. Other research has also suggested that patients feel a lack of assertiveness with their physicians,[11] and physicians themselves state that a key facilitator to good care is a patients' ability to assume responsibility and control over their diabetes.[24] A patient's life context and previous experience seem to have an influence on their care[25,26] and psychological stress and depression have been linked with poorer care.[27-29]

Alongside investigating the reasons for patients' adherence to medication,[30] more work needs to be done to study the use of alternative, traditional, or complementary medicine and its effect on patients with diabetes.[31]

Socioeconomic factors seem to have a significant effect on care: in the United Kingdom the quality of care of people with diabetes in deprived areas is poorer than those in more advantaged areas[6,32] and in the United States, uninsured patients receive lower quality of care than insured patients.[33] In New Zealand, personal finance was demonstrated to be independently associated with lower rates of home blood glucose monitoring.[13] Financial issues are likely to be more important in less prosperous countries of the world.

Clinician factors

Clinician and health professional factors described are predominantly around the areas of training, education, and knowledge of diabetes.[23] Continual medical education is vital and a key to the future may be the use of information technology. However, studies have demonstrated that even with appropriate knowledge, clinicians do not always follow suggested guidelines[34] and, therefore, other factors

such as the clinicians' health beliefs and personality have been postulated.[14] Some research has identified physicians' attitudes and beliefs as the major barriers to implementing guidelines rather than knowledge deficits.[35] Physicians, like patients, may not consider or manage diabetes as a serious problem.[36] We have all heard of patients being told they have a 'touch of sugar'. In contrast, doctors who profess a special interest in diabetes achieve better glycaemic control in their patients than others.[14]

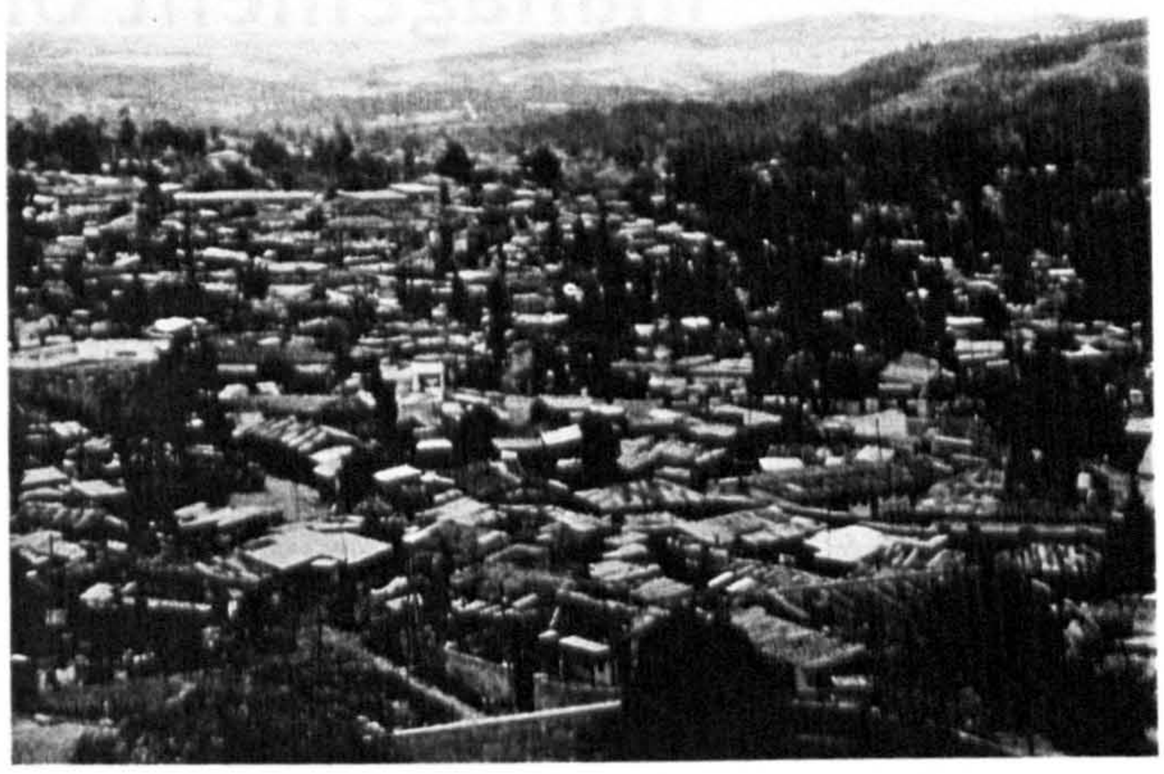
In a comprehensive review, Phillips and associates have highlighted the importance of clinical inertia of healthcare providers as a limitation to managing chronic diseases.[37] They define clinical inertia as a failure of healthcare providers to initiate or intensify therapy when indicated and this has been demonstrated in studies of physician behaviour.[38] Three major causes of clinical inertia are suggested: firstly, an overestimation of care provided; secondly, the use of 'soft' reasons to avoid intensification of therapy; and thirdly, a lack of education, training, and practice organisation focused on achieving therapeutic goals.

Health professionals themselves claim that contextual factors, usually related to organisational factors, are more important barriers to good care than knowledge or attitudes.[11,21,22] Factors quoted are lack of peer encouragement, time and financial pressures, and a lack of support staff and a team to work with. Another study reported that doctors rate diabetes as harder to treat than other chronic disorders.[35] Reasons given were lack of effective medication, complexity of treatment, the behavioural changes required by the patients, and the inevitability of future complications. Other authors have identified the issue of doctors' judgmental attitudes to patient obesity as being a key barrier to care.[36]

Doctor–patient communication has also been highlighted as a factor. A qualitative study looking into this area suggested that patients and physicians approach diabetes and its management very differently.[39] Clinicians tended to view their own management as scientific truth and to focus on managing blood sugar numbers, without attempting to understand the patients' concept of the disease and its treatment. This led to clinician frustration as well as patient non-concordance with the clinicians' advice. Other researchers have also identified discordance between patients and their clinicians' attitudes,[35] potentially jeopardising patients' ability to self-manage their diabetes and comply with treatment.[40] The patient's view of their medical care provider has also been identified as a reason for patients not responding to diabetes care intervention.[41]

Organisational factors

Organisational factors described are often related to the local situation and thus are not transferable outside of one region. However, access to healthcare services is a consistent factor, whether the barrier be a limited range of services or the distance to the available services.[23,40] Patients who require help to reach a healthcare facility have been shown to be at a higher risk of complications than others.[15] Other possible transferable factors are the use of guidelines within a structured care programme,[42] equipment of healthcare facilities, and availability of treatment and resources.[14,23] A Cochrane review of diabetes management in primary care demonstrated that unstructured care, without a system of computerised structured recall, is associated with greater mortality and worse glycaemic control than structured care.[43] A further systematic review[44] of interventions to improve the management of diabetes in primary care also confirmed that interventions which facilitate structured and regular review of patients were effective in improving the process of care. The review also concluded that the addition of patient education to these structural interventions and the enhancement of the role of nurses in diabetic care led to improvements in patient outcomes as well as the process of care. Other features of primary healthcare teams associated with improved diabetic care are good perceived teamwork, personal involvement, and a positive attitude to continued monitoring of care.[45] However, even when a practice or system is well organised, equipped, and motivated, diabetes remains a challenge due to its complexity, the presence of concomitant problems, and the longitudinal care required.[24] Consultations for patients with diabetes take time, deal with a broad range of topics and problems, and cover behavioural and lifestyle issues:[46] high-quality care of patients with diabetes is indeed a challenge!



Addis in focus: access to care is just one of many obstacles to the effective delivery of care.

The influence of culture

The influence of culture within the Western world on the management of chronic illnesses in general has been well described.[47] Some of the factors described above have been explored in ethnic minority groups within Western countries: a study of Caucasians, African-Americans and

Mexican-Americans showed some differences by race and ethnicity in healthcare access[48] and suggested that language barriers, poverty, and lack of education are important factors that influence diabetes care. However, the authors stress that the magnitude of the differences pale in comparison with the suboptimal health status of all three groups relative to established targets. Other work has shown that patients from ethnic minority groups are more likely to rank personal costs of care and physical access as barriers than others.[23] Poor literacy skills among a population of Pakistani Moslem women in the United Kingdom with diabetes has been linked with poor outcome measures.[49] In African-American women in the southern USA, important influences on self-care were spirituality, general life stress, and their multi-caregiver role; as well as the fear of complications from diabetes.[50] Other authors have also stressed the importance of religion and spirituality in patients coping with and managing their diabetes in the United States,[51] but again more needs to be done in other religious and cultural groups.[52]

An ethnographic study of diabetes in a Native American community in Canada highlighted the importance of the local concept of diabetes and in particular its relation to food.[53] This comprehensive study of a particular community's understanding of diabetes, its causation and its treatment, has enabled culturally appropriate health interventions to be developed and introduced. Other smaller studies have been undertaken highlighting the importance of health beliefs of different ethnic groups on diabetes care.[54,55]

A small number of studies have looked at the process of diabetes care in sub-Saharan Africa: studies in South Africa have highlighted lack of structured care,[43] lack of education,[56] and negative attitudes of health professionals[57] as potential barriers to improved quality of care. The place of traditional healthcare, alongside or in place of 'western' medicine, has also been highlighted.[58] Little other published work has explored the factors influencing diabetes care in Africa or the Middle East and yet it has been argued strongly that the research agenda in these regions must emphasise non-communicable diseases, and cover areas such as the study of the factors that influence patient care.[59]

Early Tunisian experience

Research has commenced in Tunisia,* using a combination of qualitative and quantitative methods, to explore the factors that influence the management of patients with type 2 diabetes in primary care. Early results of the quantitative work have confirmed large variations in diabetes care between health centres as has been demonstrated elsewhere.[5–7] Differences in health centre characteristics, and in particular the presence of a doctor with a special interest in diabetes, may have attributed to these variations.

The qualitative work has postulated many other factors that may prove to be important barriers or facilitators to care. Sources of the qualitative data have been formal and informal interviews of various health professionals (general practitioners, diabetologists, public health doctors, nurses, and clerical staff) and participant observation of meetings and health centre interactions, including patient consultations.[60] Following the same categories described above, the most commonly identified factors thus far relating to the patient are health education, attendance at the health centres, adherence to medication, and motivation to comply with health advice or tablet-taking. The most frequently cited clinician factor was the doctor's motivation, but other factors suggested were the clinicians training, workload, openness to change, and ability to communicate with patients. Organisational factors commonly cited were the availability of investigations and specialists, the locality and accessibility of the health centres, and the organisation of the national programme of diabetes and hypertension.

However, many other factors, some not previously highlighted, also seem to be relevant. Not surprisingly, supply of medication and resources is seen to be an important factor. The motivation and content of work of other health professionals, as well as the clinician, have been indicated. Observing and investigating individual centres seemed to suggest that each centre has its own 'culture' and philosophy and this may partially explain the variations in care found between the centres. Differences in care between the genders and patient use of traditional healers are two further areas that warrant further investigation. And finally, patient health beliefs and even terminology of non-communicable diseases have been identified as important areas that may influence care. For example, in Tunisia, patients label themselves as having 'soukor' (meaning diabetes, but literally translated as 'sugar'), 'damm' (meaning hypertension, literal translation is 'blood') and 'sh-ham' (meaning hypercholesterolaemia, literal translation is 'fat'). How this perception of their illness affects the patients health belief system and thus, behaviour, is as yet unknown. Further study of patients understanding of their illness will potentially facilitate improved management, by both their clinicians and themselves.

Conclusion

Quality improvement of diabetes care is vital. It will require a multifactorial approach that emphasises the role of the patient, ourselves as clinicians, and the system in which we work, as well as the interactions between them. A further understanding of the barriers and facilitators to care within all cultural settings is mandatory in order to be able to implement and enhance evidence-based, culturally appropriate diabetes care programmes.

* By the author in collaboration with the Direction du Soins de Santé de Base in Tunis.

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Factors affecting the quality of diabetes care in primary health care centres in Tunis

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Abstract

We have conducted a retrospective medical record review of a random sample of 580 patients with diabetes from 12 primary health care centres (PHCCs) in Greater Tunis. The aim was to assess the quality of diabetes care in PHCCs and to explore factors associated with quality of care. Data were collected concerning patient characteristics, health centre characteristics and process of care criteria. In our sample, recording of care varied significantly between the health centres for all of the process of care criteria studied. Factors significantly associated with improved recording of care were younger patient age (found in 5 of the 10 process of care criteria), use of the new medical records (8 of the 10 criteria), urban health centres (8 of the 10 criteria) and those centres with a doctor with a special interest in diabetes (7 of the 10 criteria). Gender and socio-economic status were not found to be associated with recording of care. The quality of diabetes care in Greater Tunis varies widely between PHCCs and a number of associated factors have been highlighted. A fuller understanding of quality of care within the context of the patients' environment is essential in order to develop appropriate health interventions.
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Keywords: Diabetes mellitus; Quality of care; Primary care

1. Introduction

Tunisia, like most countries around the world, is experiencing a major increase in non-communicable diseases such as diabetes. A doubling of the number of people with diabetes has been reported since the 1980s [1] and a recent survey in the country suggested that in the capital, Tunis, more than 10% of adults now have diabetes mellitus [2]. A large proportion of patients with Type 2 diabetes in Tunisia are managed in primary care centres within the public sector. In 1993 the Tunisian Ministry of Health initiated a national programme of hypertension and diabetes management within primary care that was extended to the whole country in 1998. The programme incorporates teaching of primary health care doctors and the use of national, standardised protocols, disease registers and new, disease-specific medical records. These records are A4 size booklets that allocate space for recording of symptoms and signs and

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recording of results as recommended in the national program.

However, the process of care of patients with diabetes is complex. The quality of care of people with diabetes is known to be variable and sub-optimal, wherever it has been studied [3–8]. To improve quality of care, information is needed about the variables that influence care and the obstacles faced in improving care. Previous research has identified scores of factors that can influence the quality of care of diabetes, generally grouped under the headings of patient, health professional and organisational factors [9–12]. To our knowledge, no such work has been undertaken in a North African setting. This study was therefore conducted to investigate the quality of care of diabetes in primary care in Tunis and in particular, to explore factors affecting the quality of care.

2. Materials and methods

Approval for the study was granted by the Tunisian Ministry of Public Health. Three health centres from each of the four regions of Greater Tunis were selected: a list of the health centres in each region was obtained and one urban and one rural centre were selected randomly from each region, using a computer-generated random number program. The third centre was purposively sampled to include a centre that was likely to be co-operating fully with the national protocols; in three of the four cases, the centre in which the regional medical co-ordinator of the national program worked was selected. The disease register at each centre was used to identify patients with diabetes mellitus managed at the health centre. A computer-generated random number program was used to select a sample of at least 20% of these patients at each centre and their medical records were studied. Data were collected from the subjects clinical records concerning patient characteristics and process of care criteria based on all clinic visits to the health centre in 2000 and 2001 (Table 1). Criteria for process of care measurements were based on the guidelines within the national program that recommends 3-monthly blood pressure, weight, fasting glucose and HbA_{1c} measurements, and annual assessments of the remaining six criteria listed in Table 1. Health centre characteristics were ascertained from the staff at the health centres.

Table 1
Variables collected from the record review

Patient characteristics
1. Age
2. Gender
3. Level of schooling
4. Health insurance coverage
5. Type of diabetes
6. Old or new medical record being used

Health centre characteristics
1. Location (region, urban/rural)
2. Size
3. Number of physicians
4. Presence of a the regional medical co-ordinator for the national program

Process of care criteria
Documentation of the following performed in 2001
1. Weight
2. Blood pressure
3. Fasting glucose
4. Cholesterol
5. Creatinine
6. HbA_{1c}
7. Fundoscopy
8. Electrocardiogram (ECG)
9. Foot examination
10. Cardiovascular examination

Descriptive analysis was performed using two by two tables for comparison of proportions and analysis of variance (or Kruskal–Wallis if data were not normally distributed) for comparison of means using the 5% level of significance.

3. Results

The medical records of 580 persons with diabetes were reviewed at the 12 health centres. The characteristics of the patients are presented in Table 2. There was a striking female preponderance with a female to male ratio of 2.3:1, despite the prevalence figure being similar [2]. The majority of patients had Type 2 diabetes: The national program has been developed predominantly for the management of patients with Type 2 diabetes, although those with Type 1 are able to attend if their physician agrees. The mean age was 60.7 years with some variation across the centres.

The number of review visits per year was identical (3.69) for patients under and over 60 years of age. Four

Table 2
Characteristics of the 580 patients at the 12 health centres

Characteristic	Mean	Range between centres
Mean number of patients per centre	48.3	25–72
Mean age (years)	60.7	53.6–64.1
Age <60 years (%)	47.4	33.3–77.3
Female (%)	70	54.2–88.8
Mean duration of diabetes (years)	8.5	5.7–10.8
Type 2 diabetes (%)	99.0	95–100
Number of review visits per year	3.69	2.86–4.76
Visits recorded in the new medical records (%)	53	5.5–100

Table 3
Documentation of care in 2001

Health care aspect	Percentage documented	Range between centres (%)
Body weight	59.2 ($n = 251$)	0–98.3
Blood pressure	95.7 ($n = 408$)	71.8–100
HbA_{1c}	4.5 ($n = 18$)	0–19.3
Serum cholesterol	43.2 ($n = 183$)	17.1–84.3
Serum creatinine	30.4 ($n = 129$)	0–52.5
Fasting blood glucose	98.8 ($n = 419$)	92.3–100
Fundoscopy	7.5 ($n = 32$)	0–25.6
Electrocardiogram	14.1 ($n = 60$)	0–37.5
Foot examination	43.4 ($n = 184$)	0–94.3
Cardiovascular examination	60.1 ($n = 255$)	0–96.8

Patients with at least one visit in the year included only ($n = 424$).

hundred and twenty-four patients of our sample (73%) attended their health centre at least once during the calendar year of 2001 and documentation of care for these patients is listed in Table 3.

The number of patient consultations per year at each health centre varied between 6384 and 27,108 and the number of doctors per centre ranged from 1 to 6. The average number of consultations per doctor per year was 4027, ranging from 1596 to 9119. Seven centres were urban and five were rural: In Region A, the central region of Greater Tunis, all the centres are urban and therefore we were unable to select a rural centre.

3.1. Patient factors

Younger patients (under 60 years of age) were found to have significantly higher levels of recording of care than older patients for 5 of the 10 measures recorded (see Fig. 1). No associations were found with gender or socio-economic status (using health insurance coverage and level of schooling as our indicators).

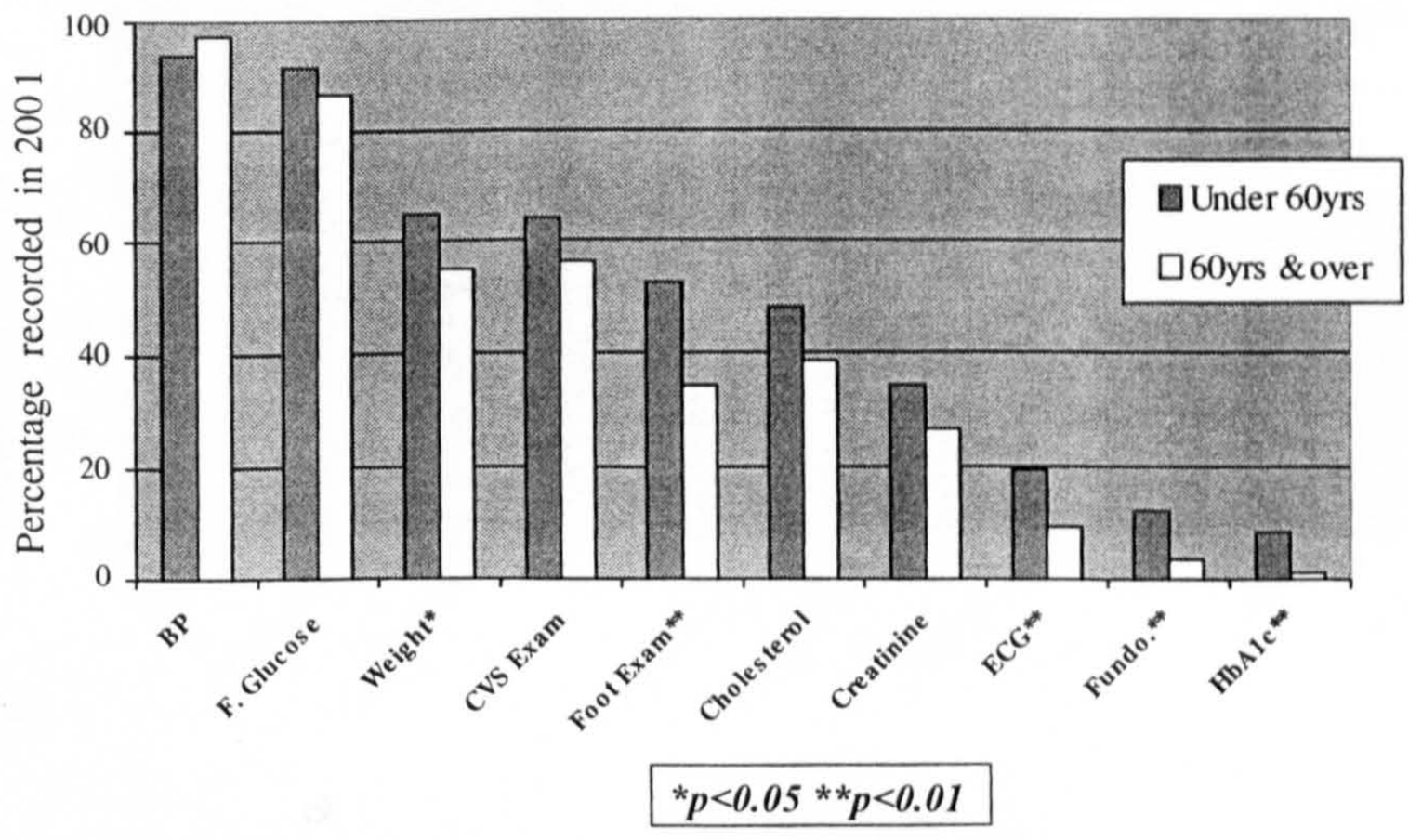

Fig. 1. Recording of care by age group. $^{*}p < 0.05$, $^{**}p < 0.01$; F-glucose: fasting glucose, CVS exam: cardiovascular examination, Foot exam: foot examination and Fundo.: fundoscopy.

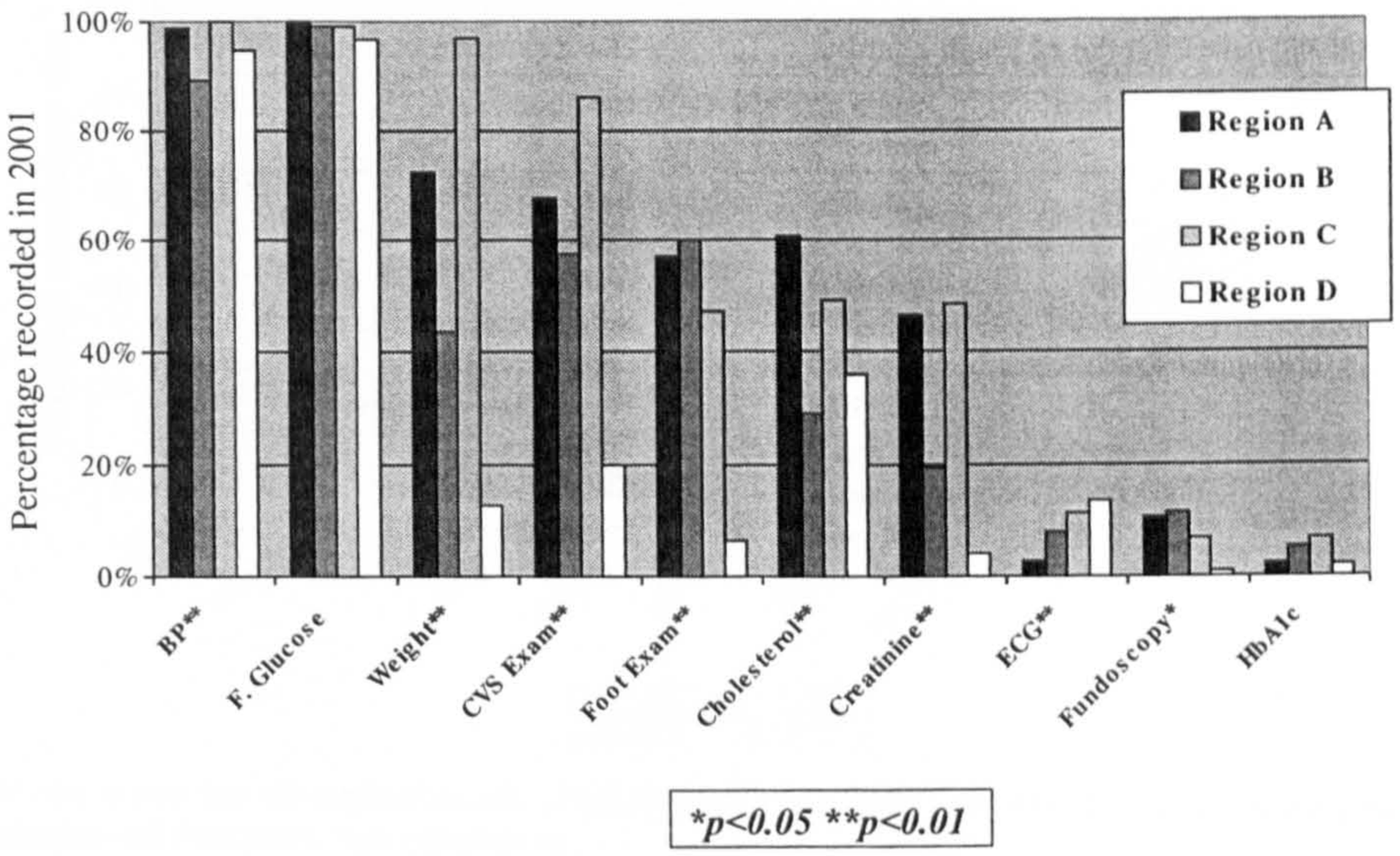

Fig. 2. Recording of Care by region. $^{*}p < 0.05$, $^{**}p < 0.01$; F-glucose: fasting glucose, CVS exam: cardiovascular examination, Foot exam: foot examination and Fundo.: fundoscopy.

Patients with a higher level of schooling were more likely to have had an HbA_{1c} performed only.

3.2. Health centre factors

Large variations of recording of care were found between the 12 health centres for all the measurements recorded (see Table 3). These variations were also found between the four regions within Greater Tunis (see Fig. 2). No one region had superior levels of recording of care for all the measures, although region D tended to have lower levels than the other regions.

The urban health centres had significantly higher levels of recording of care than the rural centres in 8 of

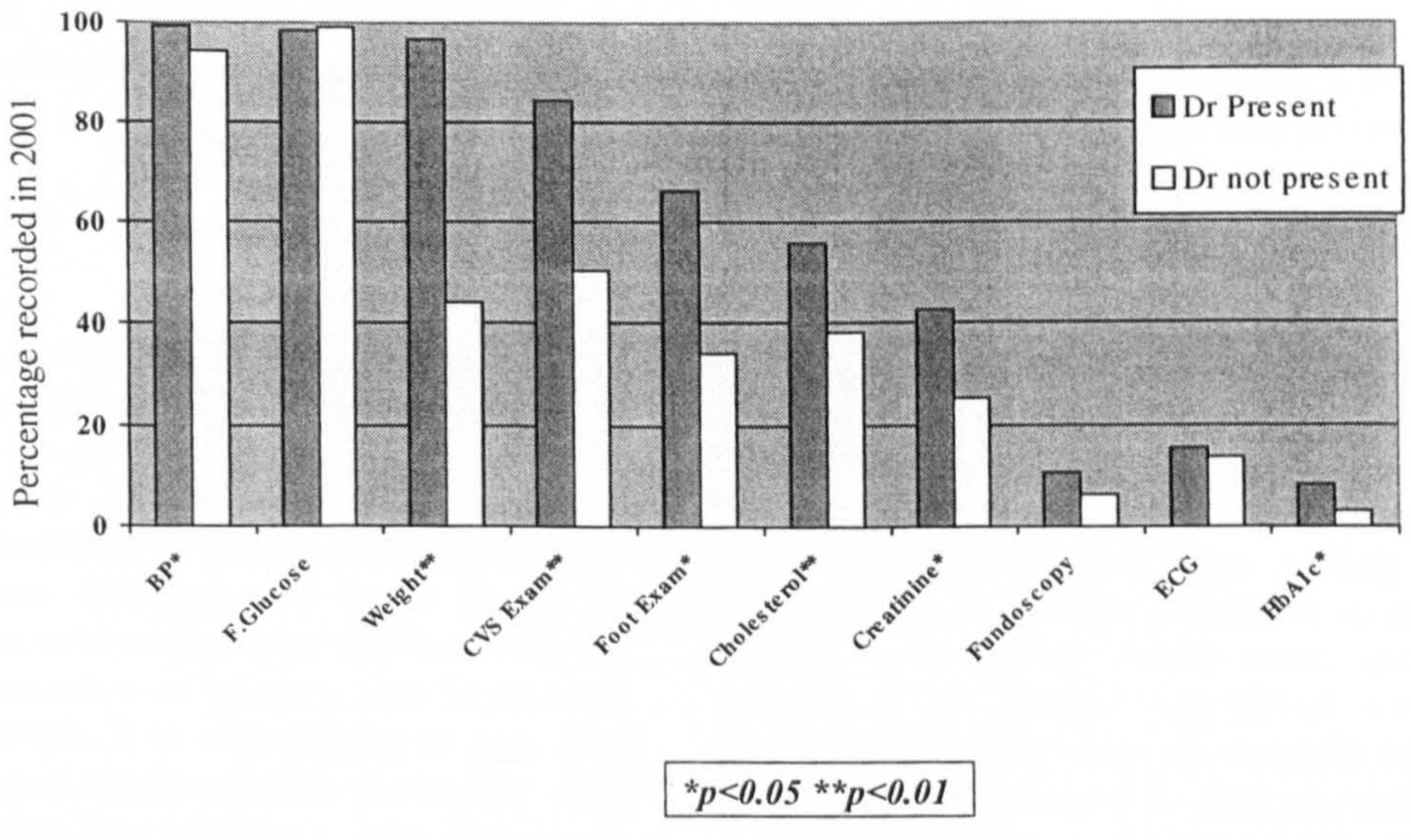

Fig. 3. Recording of care in centres with and without a doctor with a special interest in diabetes. $^{*}p < 0.05$, $^{**}p < 0.01$; F-glucose: fasting glucose, CVS exam: cardiovascular examination and Foot exam: foot examination.

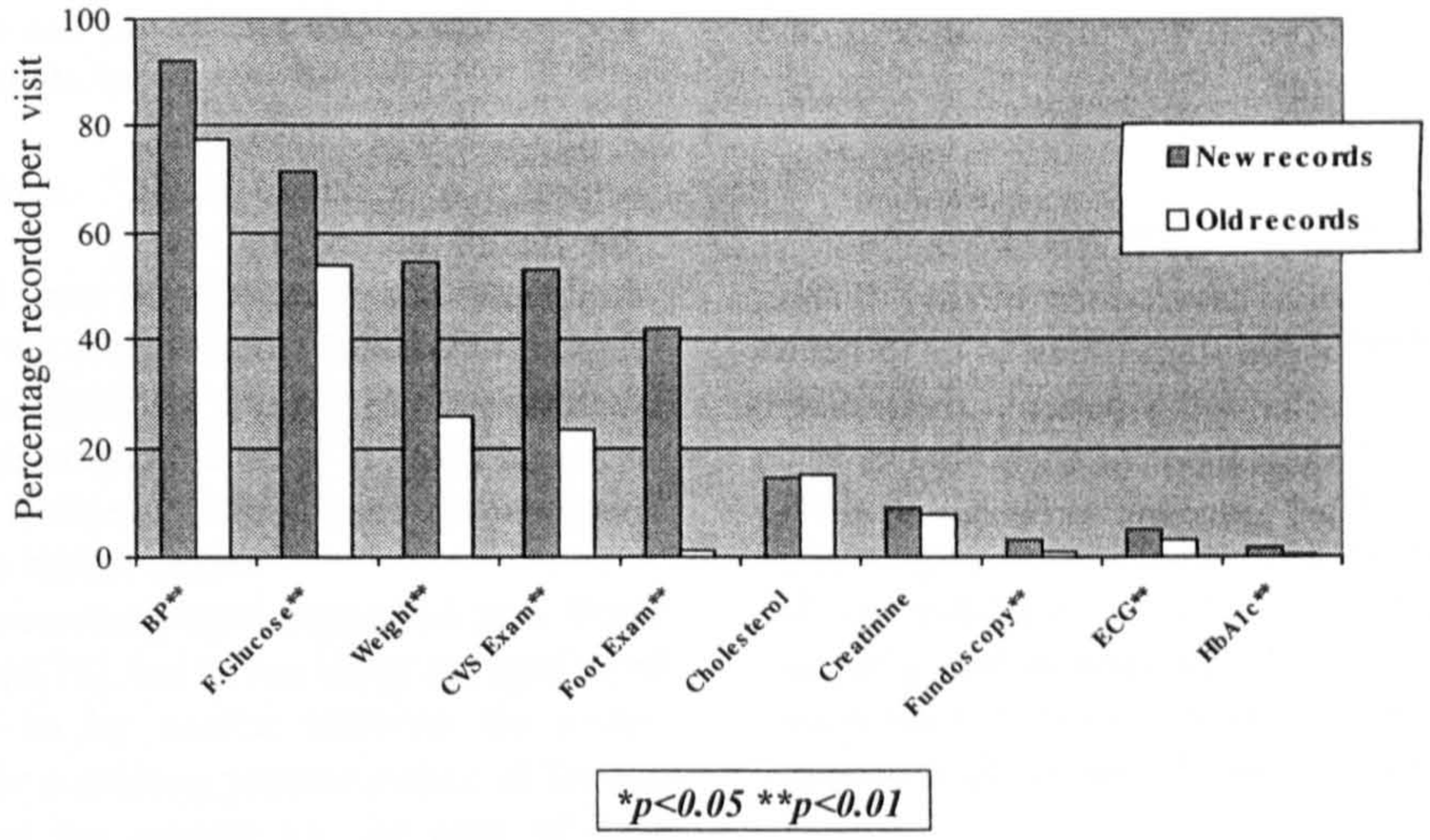

Fig. 4. Recording of care in new and old medical records (2000 and 2001). $^{*}p < 0.05$, $^{**}p < 0.01$; F-glucose: fasting glucose, CVS exam: cardiovascular examination and Foot exam: foot examination.

the 10 measures. The size of the health centre (according to the number of patients seen or the number of doctors) was not related to documentation of care. However, the three centres in which a doctor with a special interest in diabetes worked (as a regional co-ordinator for the national program) were found to have significantly higher levels of recording of care for 7 of the 10 measures (Fig. 3). In addition, patient visits recorded in the new medical records were associated with significantly higher levels of recording of care for 8 of the 10 measurements (see Fig. 4).

4. Discussion

Our study of the quality of diabetes care in primary care health centres in Tunis demonstrates a large variation in care between health centres and between regions. It is acknowledged that this study relies on the recording of care and not necessarily the care that was delivered, and that 4 of the 12 centres were not randomly chosen and thus may not be fully representative of primary care in Greater Tunis. Nevertheless, it is encouraging to note that the process of care results compare favourably with published studies from primary care elsewhere [3,5,6,13].

We have used recording of care as our indicator of quality, as there is evidence that the quality of record keeping is positively correlated with increased quality of care [14,15]. Although there has been recent concern about the validity and reliability of using medical records to assess quality of care [16], studies in countries such as ours are not at present able to use measures such as complication rates or HbA_{1c} results.

One striking result is the low number of patients having had an HbA_{1c} recorded given its recommendation in the national guidelines. This is likely to be due to the fact that this test is not available free for patients seen in primary care, unlike the other examinations. The association between having had the test performed and a higher level of schooling, and thus potential for a higher salary, supports this hypothesis.

A further alarming result is the low recording of fundoscopy. In Tunisia, fundoscopy is performed only by ophthalmologists who work in busy regional hospitals and often have long waiting times for appointments. In addition, results are rarely communicated to the primary health centre and thus not recorded in the primary care health records. Pilot studies around the country are currently underway to train general practitioners to perform fundoscopy.

Our results shed some light on the patient, clinician and organisational factors that may be causing

variations of care and preventing high quality of care of patients with diabetes.

4.1. Patient Factors

Older patients seem to have poorer quality of care: this may be due to concomitant illnesses or to health professionals (and perhaps the patients themselves) judging that tight management of their illness is no longer essential. It does not seem to be due to poorer attendance at the health centre.

Gender has previously been suggested as a factor influencing care [8,17], but in our study the quality of care was found to be similar between the sexes. However, there is a striking predominance of female patients attending the centres for the care of their diabetes. Possible reasons for this are that men may find it difficult to attend the health centres as they are only open during morning working hours or they may view their illness as less serious than women.

We used health insurance coverage and level of schooling as our deprivation indicators as this information is routinely collected and recorded in the health records. Apart from recording of HbA_{1c}, as mentioned above, no associations were found with quality of care in our study. Studies in Europe and North America have demonstrated that patients from deprived areas receive poorer quality of care [3,18,19]; our finding may be a true negative finding or may be due a lack of sensitivity of our indicators.

The number of visits per year by patients (see Table 2) appears high and suggests that those patients who are attending the centres are attending regularly. However, 27% of patients did not attend their health centre at all during 2001. There are a number of possible reasons; they may be attending private clinics or secondary care, they may have moved area or died, or alternatively they may not understand the value of routine care.

4.2. Physician factors

Our finding that the centres in which the regional co-ordinator for the national program worked had improved recording of care, was expected. This finding supports the hypothesis that motivating and training doctors will improve the management of patients with diabetes.

4.3. Health centre factors

Improved process of care outcomes at urban health centres may be due to the patients' closer proximity to the health centre and to hospitals and laboratory facilities. The variation of care between the four regions of Greater Tunis suggests that broader regional factors, such as the organisation and personnel at the regional level, may be affecting the quality of care of patients at the health centres. Finally, we are encouraged by the positive association of recording of care and the use of the new disease-specific medical records; studies elsewhere have continually shown an association between organised, structured care and improved processes of care [20–22].

5. Conclusion

Although the quality of care of patients is a complex and multi-dimensional phenomenon [23], we have demonstrated a number of factors that appear to be affecting the quality of care of patients with diabetes in Tunis. Qualitative studies within the primary care health centres have commenced alongside seeking the views of patients and providers, in order to seek a fuller insight into these factors. It is crucial that we gain a better understanding of the processes of care within the context of the patients' environment in order to develop culturally appropriate health interventions.

Acknowledgements

We would like to thank all the staff and patients at the participating primary care health centres for their help and hospitality.

References

[1] L. Papoz, F. Ben Khalifa, E. Eschwege, et al. Diabetes mellitus in Tunisia: description in urban and rural populations, Int. J. Epidemiol. 17 (1988) 419–422.
[2] Institut National de Nutrition, Evaluation de l'etat nutrionnel de la population Tunisiene, Enquete Nationale, Tunis, 1996–1997.

[3] K. Khunti, S. Ganguli, R. Baker, et al. Features of primary care associated with variations in process and outcome of care of people with diabetes, Br. J. Gen. Pract. 51 (2001) 356–360.
[4] D.R. Arday, B.B. Fleming, D.K. Keller, et al. Variation in diabetes care among states, Diabetes Care 25 (2002) 2230–2237.
[5] M.C. Gulliford, D. Mahabir, A five-year evaluation of intervention in diabetes care in Trinidad and Tobago, Diabet. Med. 16 (1999) 939–945.
[6] N.S. Levitt, M.F. Zwarenstein, S. Doepfmer, et al. Public sector primary care of diabetes—a record review of quality of care in Cape Town, S. Afr. Med. J. 86 (1996) 1013–1017.
[7] M. El-Shazly, M. Abdel-Fattah, A. Zaki, et al. Health care for diabetic patients in developing countries: a case from Egypt, Pub. Health 14 (2000) 276–281.
[8] M. Pringle, C. Stewart-Evans, C. Coupland, et al. Influences on control in diabetes mellitus: patient, doctor, practice or delivery of care? Br. Med. J. 306 (1993) 630–634.
[9] B.B. Brown, S.B. Harris, S. Webster-Bogaert, et al. The role of patient, physician and systemic factors in the management of type 2 diabetes mellitus, Fam. Pract. 19 (2002) 344–349.
[10] D. Simmons, T. Weblemoe, J. Voyle, et al. Personal barriers to diabetes care: Lessons from a multi-ethnic community in New Zealand, Diabet. Med. 15 (1998) 958–964.
[11] M.H. Chin, S. Cook, L. Jin, et al. Barriers to providing diabetes care in community health centres, Diabetes Care 24 (2001) 268–274.
[12] K. Khunti, Use of multiple methods to determine factors affecting quality of care of patients with diabetes, Fam. Pract. 16 (1999) 489–494.
[13] N. Dunn, P. Bough, Standards of care of diabetic patients in a typical English community, Br. J. Gen. Pract. 46 (1996) 401–405.
[14] D.H. Solomon, J.L. Schaffer, J.N. Katz, et al. Can history and physical examination be used as markers of quality? An analysis of the initial visit note in musculoskeletal care, Med. Care 23 (2000) 383–391.
[15] K.L. Kahn, W.H. Rogers, L.V. Rubenstein, et al. Measuring quality of care with explicit process criteria before and after implementation of a DRG-based prospective payment system, JAMA 264 (1990) 1969–1971.
[16] A.N. Goudswaard, K. Lam, R.P. Stolk, et al. Quality of recording of data from patients with type 2 diabetes is not a valid indicator of quality of care: a cross-sectional study, Fam. Pract. 20 (2003) 173–177.
[17] J.C. Zgibor, D. Simmons, Barriers to blood glucose monitoring in a multiethnic community, Diabetes Care 25 (2002) 1772–1777.
[18] V. Connolly, N. Unwin, P. Sherriff, R. Bilous, B. Kelly, Diabetes prevalence and socio-economic status: a population based study showing increased prevalence of type 2 diabetes mellitus in deprived areas, J. Epidemiol. Health 54 (2000) 173–177.
[19] D.S. Porterfield, L. Kinsinger, Quality of care for uninsured patients with diabetes in a rural area, Diabetes Care 25 (2002) 319–323.
[20] S. Griffin, Al. Kinmouth, Diabetes care: the effectiveness of systems for routine surveillance for people with diabetes (Cochrane review), 1999.
[21] C.M. Renders, G.D. Valk, S.J. Griffin, et al. Interventions to improve the management of diabetes in primary care, outpatient and community settings: a systematic review, Diabetes Care 24 (2001) 182–1833.
[22] J.J. de Sonnaville, M. Bouma, L.P. Colly, et al. Sustained good glycaemic control in NIDDM patients by implementation of structured care in general practice: 2-year follow-up study, Diabetologia 40 (1997) 1334–1340.
[23] S.M. Campbell, M.O. Roland, S. Buetow, Defining quality of care, Soc. Sci. Med. 51 (2000) 1611–1625.

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ORIGINAL RESEARCH

Disease-specific medical records improve the recording of processes of care in the management of type 2 diabetes mellitus

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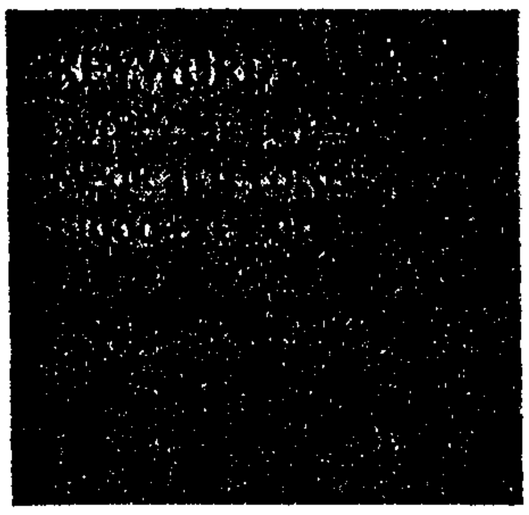

Summary A retrospective review of the medical records of 961 patients with type 2 diabetes managed in primary care in Tunisia was undertaken. Recording of process of care measurements improved from 65 to 84% for blood pressure, from 60 to 71% for fasting glucose, and from 11 to 53% for weight measurement ($P<0.001$ for all). The introduction of disease-specific medical records significantly improves the recording of care of patients with type 2 diabetes mellitus.
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Introduction

The quality of care for patients with diabetes mellitus has been shown to be variable and suboptimal wherever it has been studied around the world,[1-5] despite the evidence that good control of blood pressure and glucose significantly reduces the risk of cardiovascular and microvascular complications.[6-8] Systematic reviews have demonstrated that structured systems that facilitate regular review of patients are effective in improving the process of care.[9,10]

Tunisia, like all countries in the Eastern Mediterranean region, is experiencing a major increase in non-communicable diseases such as diabetes. A doubling of the number of people with diabetes has been reported since the 1980s,[11] and a recent survey in the country suggested that more than 10% of adults in the capital city, Tunis, now have diabetes mellitus.[12] Over the last 10 years, the Tunisian Ministry of Health has gradually instituted a national programme of hypertension and diabetes management within primary care health centres (PHCCs) that includes the use of disease-specific medical records.[13] These records are A4-sized booklets that allocate space for recording of symptoms and signs, and recording of results as recommended in the national programme.

The aim of this study was to test the hypothesis that the introduction of disease-specific medical records has improved the documentation of care.

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Table 1 Process of care documentation. Percentage of visits in which each measurement was recorded.

	All years			2000			2001			2002		
	DSR (*n*=3980)	SGR (*n*=3950)	Mixed[a] DSR SGR	DSR (*n*=760)	SGR (*n*=1286)		DSR (*n*=1322)	SGR (*n*=1379)		DSR (*n*=1898)	SGR (*n*=1209)	
Glucose	71	60	65 71 63	70	59	69	70	62	65	72	59	63
Blood pressure	84	65	85 87 69	85	69	77	83	65	74	84	63	73
Weight	53	11	54 53 19	54	13	31	54	11	31	52	9	19

DSR, disease-specific records; SGR, standard general records. All results were significantly higher for the new records using 2×2 tables ($p<0.001$).
[a] The subgroup of patients who changed from using the standard records to the new records during the time frame of the study.

Materials and methods

The study population consisted of patients with type 2 diabetes mellitus managed in PHCCs in the 13 regions of central and northern Tunisia. Approval for the study was granted by the Tunisian Ministry of Public Health. Two health centres were selected at random from each region, and patients were selected at random from each health centre for review of their medical records. Manual, chronic disease registers at the health centres were used to select patients with diabetes mellitus. Patients with type 1 diabetes were excluded according to the treating clinician's diagnosis based on clinical grounds. Data were collected regarding patient characteristics and process of care criteria from all patient visits to the health centre in 2000, 2001 and 2002. All process of care measures recommended by the national programme of hypertension and diabetes management[13] were recorded, but for the sake of this analysis, only those recommended to be performed at every 3-monthly visit were chosen (fasting glucose, blood pressure, weight). Ideally, we would have liked to include glycosylated haemoglobin (HbA1c) as a variable, but this is not yet widely available in primary care in Tunisia. Documentation of care in the new disease-specific medical records was compared with that in the standard general medical records.

Statistical analysis was performed using the Chi-squared test with Minitab (version 13.1) software.

Results

Nine hundred and sixty-one patient records were selected from the 26 health centres. Of these, 433 patients had all their visits recorded in disease-specific medical records, 318 patients had all their visits recorded in standard general medical records, and 210 patients changed during the course of the study from the standard records to the disease-specific records.

The mean age of patients in the study was 61.7 years, the mean duration of diabetes was 8.2 years, and the ratio of women to men was 2:1. There were no significant differences in these characteristics between the groups. Data from 7930 visits to the health centres were collected; of these, 3980 were recorded in disease-specific medical records and 3950 were recorded in standard general medical records. The proportion of visits recorded in disease-specific medical records increased from 37% in 2000 to 60% in 2002.

Recording of process of care measurements was significantly higher in disease-specific medical records compared with standard general medical records (Table 1). These results were consistent for each of the three calendar years when analysed independently, and also for the subgroup of patients who changed from using the standard records to the new records during the time frame of the study (Table 1).

Discussion

We have confirmed the hypothesis that the introduction of disease-specific medical records significantly improves the recording of care of patients with type 2 diabetes mellitus.

We acknowledge that recording of care does not necessarily relate to what is done, and it is possible that the same quality of care was being performed but not recorded in the standard general medical records. If so, the improved recording of care has benefits apart from improved quality of care for the patients, such as the potential for audit and evaluation.

The high female:male ratio of patients attending for diabetes care in our study is striking. The prevalence rate in Tunisia is similar,[12] but other recent studies have also shown a higher rate of consultation of women.[14,15] This area of interest certainly warrants further study. Our paper adds useful information to previous work in Tunis that demonstrated great variation in the care of patients with diabetes across health centres.[14] Other variables, such as smoking habit, body mass index and patient medications, along with intermediate outcomes of care, were also measured (to be published elsewhere), and measures are currently underway within the national programme to improve both the recording and outcomes of care for patients with diabetes.

There are possible confounding factors to our results. We have attempted to exclude the possibility of patient differences between the groups by comparing the basic characteristics of age, gender and duration of diabetes. We also analysed the subgroup of patients who changed from using standard general medical records to disease-specific medical records during the 3 years that our study covered, and found that the results remained significant. Disease-specific medical records have been introduced gradually, and the improved recording may be due to improved recording over time. However, the significant improvement with disease-specific medical records was found to be true within each of the calendar years studied when analysed independently. Overall, as the statistical significance of our results was high, we are confident that the findings are accurate. Although the findings may have been expected, it is essential that interventions in health care can be proved to be evidence based. Our results, like those in similar low- to middle-income countries,[1,2] demonstrate that the quality of care of patients with chronic diseases has room for improvement. Systematic reviews of diabetes management have demonstrated that structured care with computerized recall improves the process of care,[9] but many countries do not have the luxury of computers in primary care. We would recommend that all countries without the resources to use computerized systems consider introducing disease-specific medical records for the management of their patients with chronic diseases.

References

1. Akel H, Hamadeh G. Quality of diabetes care in a university health center in Lebanon. *Int J Qual Health Care* 1999;11: 517-21.
2. El-Shazly M, Abdel-Fattah M, Zaki A, Bedwani R, Assad S, Tognoni G, et al. Health care for diabetic patients in developing countries: a case from Egypt. *Public Health* 2000;114:276-81.
3. Dunn N, Bough P. Standards of care of diabetic patients in a typical English community. *Br J Gen Pract* 1996;46:401-5.
4. Arday DR, Fleming BB, Keller DK, Pendergrass PW, Vaughn RJ, Turpin JM, et al. Variation in diabetes care among states. *Diabetes Care* 2002;25:2230-7.
5. Tapp RJ, Zimmet PZ, Harper CA, de Courten MP, Balkau B, McCarty DJ, et al. Diabetes care in an Australian population. *Diabetes Care* 2004;27:688-93.
6. UK Prospective Diabetes Study Group. Intensive blood glucose control with sulphonylureas or insulin compared with conventional therapy and risk of complications in patients with type 2 diabetes: UKPDS 34. *Lancet* 1998;352:854-65.
7. Hannson L, Lennart A, Carruthers SG, Dahlof B, Elmfeldt D, Julius S, et al. Effects of intensive blood pressure and low dose aspirin in patients with hypertension: principal results of the hypertension optimal treatment (HOT) randomised trial. *Lancet* 1998;351:1755-62.
8. UK Prospective Diabetes Study Group. Tight blood pressure and risk of microvascular and macrovascular complications of type II diabetes: UKPDS 38. *Br Med J* 1998;317:701-13.
9. Griffin S, Kinmouth Al. *Diabetes care: the effectiveness of systems for routine surveillance for people with diabetes (Cochrane Review). The cochrane library, Issue 2.* Oxford: Update Software; 1999.

10. Renders CM, Valk GD, Griffin SJ, Wagner EH, van Eijk JThM, Assendelft WJJ. Interventions to improve the management of diabetes in primary care, outpatient and community settings: a systematic review. *Diabetes Care* 2001;24:182-3.
11. Papoz L; Ben Khalifa F, Eschwege E, Ben Ayed H. Diabetes mellitus in Tunisia: description in urban and rural populations. *Int J Epidemiol* 1988;17:419-22.
12. Institut National de Nutrition. *Evaluation de l'etat nutrionnel de la population Tunisiene*. Enquete Nationale 1996-97. Tunis: Institut National de Nutrition.
13. Direction des Soins de Santé de Base. *Programme National de Prise en Charge des Diabétiques dans les Structures de 1 ère Ligne*. République Tunisienne: Ministère de la Santé Publique; 2001.
14. Alberti H, Boudriga N, Nabli M. Variations in care of diabetes in primary care centres in Tunis. *Diabetes Metab* 2004;30: 197-200.
15. Yount KM, Agree EM, Rebellon C. Gender and use of health care among older adults in Egypt and Tunisia. *Soc Sci Med* 2004;59:2479-97.

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felt that they could be used to record anything that was relevant to their health.

The recording time limits the amount of information that can be stored on the DRDs. One minute is enough to record summary information or details of medication, but if longer explanations are required or a patient is on multiple medications it is not sufficient.

The DRDs can be re-used but their re-use is dependent on patients returning with them at their next appointment. There could be a danger in giving patients multiple devices as messages could get out of date or mixed up. Some form of labelling on the outside of the device could overcome this.

The DRDs used in this pilot were reliable, used frequently and found to be acceptable. It is possible to see that a small investment in DRDs could have an impact on attendance rates and compliance with prescribed medication that, in turn, could contribute to reducing any waste of NHS resources. The cost of the DRDs needs to be considered against the above patient benefits.

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Competing interests

The authors have stated that there are none.

REFERENCES

1. Goodwin Y. Do they listen? A review of information retained by patients following consent for reduction mammoplasty. *Br J Plas Surg* 2000; **53:** 121–125.
2. Kessels RPC. Patients' memory for medical information. *J R Soc Med* 2003; **96:** 219–222.
3. Anderson JL, Dodman S, Kopelman M, Fleming A. Patient information recall in a rheumatology clinic. *Rheumatol Rehabil* 1979; **18:** 18–22.

Ensuring confidentiality

Sokol and Car[1] suggest that identification of patients over the telephone is impossible because others may impersonate patients to request test results, breaching confidentiality. A suggestion is that patients be seen face-to-face and no information be given over the telephone. Besides increasing the amount of work in surgery and inconvenience to patients, I do not believe that this would achieve the objective. It cannot be guaranteed that the person who comes into the consulting room is who they say they are. In fact, worryingly often they are not, either due to mistake (such as deafness), or, quite possibly, by impersonation, and I cannot identify all our practice patients by sight, and never will be able to.

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REFERENCE

1. Sokol D, Car J. Protecting patient confidentiality in telephone consultations in general practice. *Br J Gen Pract* 2006; **56:** 384–385.

Written on the body

John Salinsky might like to know that I once completed a dermatology quiz at our local postgraduate centre simply by describing each of the displayed slides in what little remained of my schoolboy Latin. That, so far as I was concerned, was the diagnosis. I came top!

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Competing interests

Failed O-level Latin; but it didn't matter as by then Leeds did not require Latin for admission to the Medical School.

REFERENCE

1. Salinsky J. Written on the body. *Br J Gen Pract* 2006; **56:** 470–471.

Sex inequalities

Hippisley-Cox *et al* have reported evidence of sex inequalities in access to care for diabetes in primary care in the UK.[1] We are undertaking a national study of the factors that influence the care of patients with diabetes in Tunisian primary care health centres, including a retrospective medical review of over 2000 patients from 48 centres. Our results suggest that sex inequalities in the care of patients with diabetes are international.

In our study,[2] women with diabetes attending health centres are significantly younger than men, less likely to have type 1 diabetes, less educated, less likely to be working, less likely to be smokers and to drink alcohol and more likely to have cardiovascular disease. Women also have significantly higher levels of systolic and diastolic blood pressure, total cholesterol and body mass index but lower mean creatinine levels than men. These findings were all to be expected. However, Table 1 shows a selection of other data related to access of care suggesting significant *differences between the care of men and* women. Women are more likely to attend their appointment on time, but the time until their next given appointment is significantly longer. Women are also less likely to have their care recorded in the new disease-specific medical records. This is important, as we have shown that use of these records is associated with improved quality of care.[3]

Sex inequalities in the care of patients with diabetes in primary care are not limited to the UK. We sincerely agree that further work is required to confirm, and if possible, explain these findings, and to seek ways of correcting these inequalities.

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REFERENCES

1. Hippisley-Cox J, Yates J, Pringle M, *et al*. Sex inequalities in access to care for patients with diabetes in primary care: questionnaire survey. *Br J Gen Pract* 2006; **56:** 342–348.
2. Bouguerra R, Alberti H, Ben Salem L, *et al*. The global diabetes pandemic: the Tunisian experience. *Eur J Clin Nutr*: in press.
3. Alberti H, Boudriga N, Nabli M. Disease-specific medical records improve the recording of processes of care in the management of type 2 diabetes mellitus. *Public Health*: in press.

Table 1. Differences between the care of men and women.

Factor	Men (n = 841)	Women (n = 1319)	P-value[a]
Mean age (years)	58.01	60.88	<0.001
Number of visits in preceding 12 months	3.65	3.75	0.07
Mean time until next appointment (days)	81.62	84.58	0.033
Consultations >2 weeks late (%)	27.7	23.3	0.082
New records used (%)	89.3	84.8	0.08
Completion of new records (score of 12 variables)	7.11±4.22	6.68±4.27	0.014

[a]*P-value using logistic regression with sex as the dependent variable and the factor in question plus age and health centre entered as the explanatory variables.*

Improvements in quality of care of patients with diabetes in primary care in Tunisia

H Alberti, N Boudriga, M Nabli*

ABSTRACT

Worldwide, the quality of diabetes care is suboptimal, yet few studies have been undertaken in primary care in developing nations. We sought to evaluate whether the quality of diabetes care in primary care health centres in Tunisia has improved since the initiation of a National Program of Hypertension and Diabetes Management.

We conducted a retrospective medical review of process and outcome measures and treatment of patients with type 2 diabetes attending primary care health centres in Tunisia. Data were collected from patients attending 48 randomly selected health centres from the whole country from 2000–2002, and a subset of patients attending 14 randomly selected centres from the south of the country from 2000–2004.

The national cohort included 2030 patients, and the southern subset 593. Six of nine process measurements improved significantly in the national cohort, five of nine in the southern subset ($p<0.05$). There were significant improvements in body mass index and a trend towards improvement in fasting glucose level over the three-year period nationally, and significant improvements in body mass index, fasting glucose and diastolic blood pressure over the five-year period in the southern cohort. Highly significant increases in the proportion of patients being prescribed lipid-lowering agents (1.9% *vs* 7.8%, $p<0.001$) and ACE inhibitors (8.5% *vs* 14.7%, $p<0.001$) were also noted in the national cohort.

We have demonstrated a possible trend in improvement in the quality of care of patients with diabetes managed in the primary care setting in Tunisia over a five-year period from 2000–2004.

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KEY WORDS

diabetes care; quality of care; primary care

Introduction

Worldwide, the quality of care of patients with diabetes has been shown to be variable and suboptimal,[1–6] despite the evidence that good control of blood pressure and glucose significantly reduces the risk of cardiovascular and microvascular complications.[7,8] Systematic reviews have demonstrated that structured systems which facilitate regular review of patients are effective in improving the quality of care,[9,10] and initiatives have been implemented within primary care in various countries.[10,11]

Tunisia, like most countries in Africa and the Middle East, is experiencing a major increase in non-communicable diseases such as diabetes.[12] Indeed, 80% of all chronic disease deaths worldwide now occur in low and middle income countries where most of the world's population live.[13] In response, the Tunisian Ministry of Public Health has initiated a National Program of Hypertension and Diabetes Management within primary care with the aim of improving the quality of care of patients with type 2 diabetes;[14,15] the programme was initiated in 1993 and extended to the whole country in 1998. The programme incorporates teaching of primary health care doctors and the use of national, standardised protocols, disease registers and new, disease-specific medical records. There has also been an emphasis on patient education, prioritising the availability of medications for chronic diseases and introducing chronic disease clinics.

Very few studies of the quality of diabetes care have been undertaken within developing nations. Following on from earlier work undertaken in the capital, Tunis,[16] we conducted a nationwide study of primary health care centres in Tunisia to assess any improvements in diabetes care since the implementation of the national programme.

Methods

Tunisia is a country of 10 million inhabitants, situated on the North African coast. There are approximately 2000 public sector, primary care health centres situated throughout the 24 regions of the country. The majority of these centres are small, nurse-run health posts and we therefore chose to include only those centres that held medical consultations four or more times a week (n=567, 2004 data). Our study is a retrospective, medical record review of a random sample of patients with type 2 diabetes managed in these centres. Two health centres were randomly selected from each region (one urban and one rural) and up to 50 patients were randomly selected from each health centre for medical record review. A list of urban and rural health centres from each region was obtained from the Ministry of

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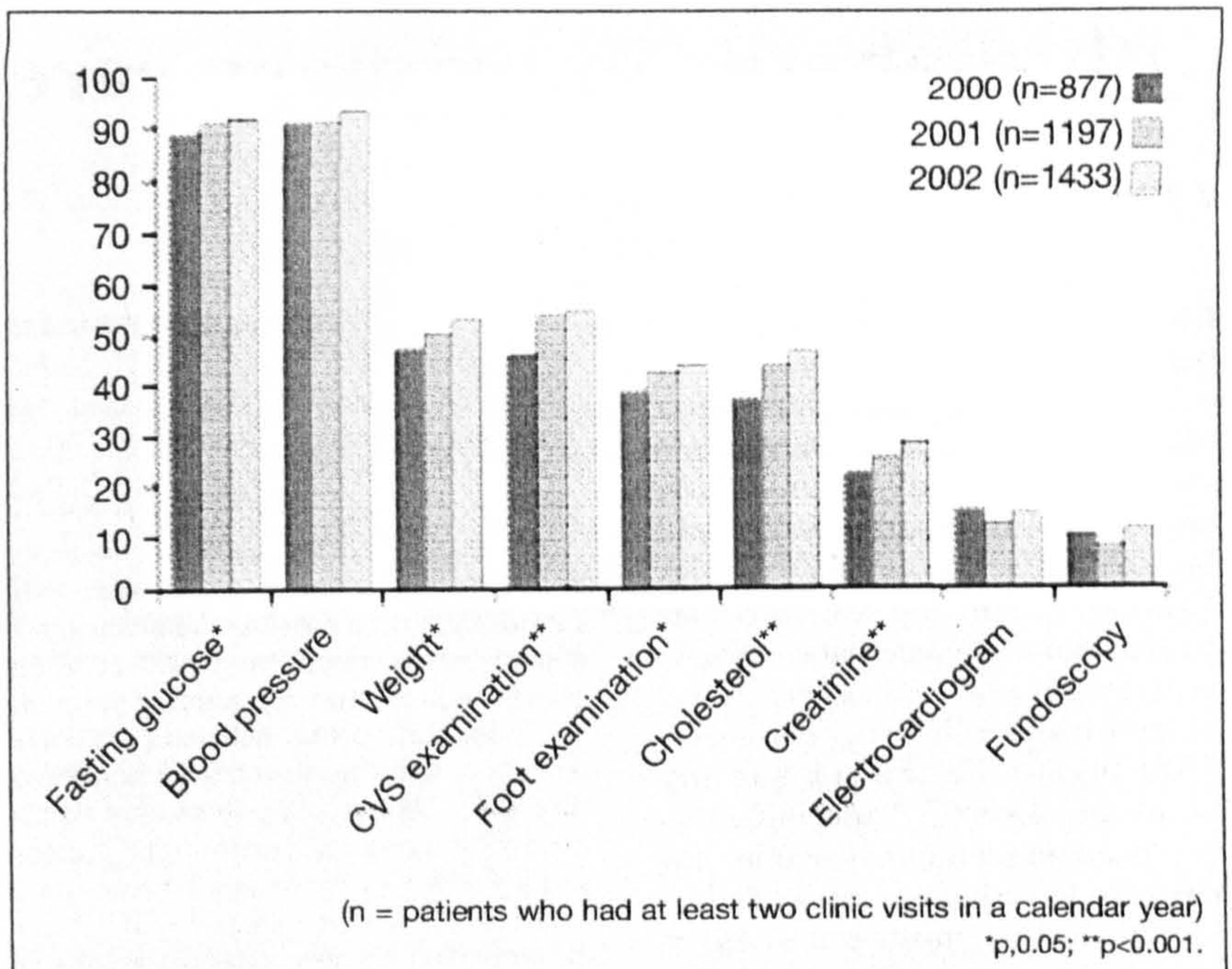
Public Health and lists of patients with diabetes were obtained from manual, chronic disease registers at each health centre. Centres and patients were then selected using a computerised, random number program. Patients with type 1 diabetes were later excluded using standard criteria for epidemiological studies,[17] i.e. patients diagnosed at <35 years of age and with requirement for insulin were categorised as type 1. Data were collected regarding patient characteristics, processes of care (i.e. whether a test had been recorded in a 12-month period), outcomes of care (i.e. the result of the test) and medications prescribed. All measures recommended by the National Program of Hypertension and Diabetes Management were recorded, except for glycosylated haemoglobin (HbA_{1c}) which is not yet widely available in primary care in Tunisia. Thus, the measurements included were: fasting glucose, blood pressure, weight, cardiovascular examination, foot examination, cholesterol, creatinine, electrocardiogram and eye examination. The latter four tests would usually require referral to a local hospital, as they cannot be performed on site at the health centre.

Data were collected on all clinic visits of patients from 1 January 2000 up until the time of data collection (between 2003 and 2005). Full data were available for: firstly, a national cohort of patients from all 24 regions (48 health centres) including clinic visits in 2000, 2001 and 2002; and, secondly, a subset of patients from the last seven regions (14 health centres) to be visited, from the south of the country, including clinic visits up to the end of 2004.

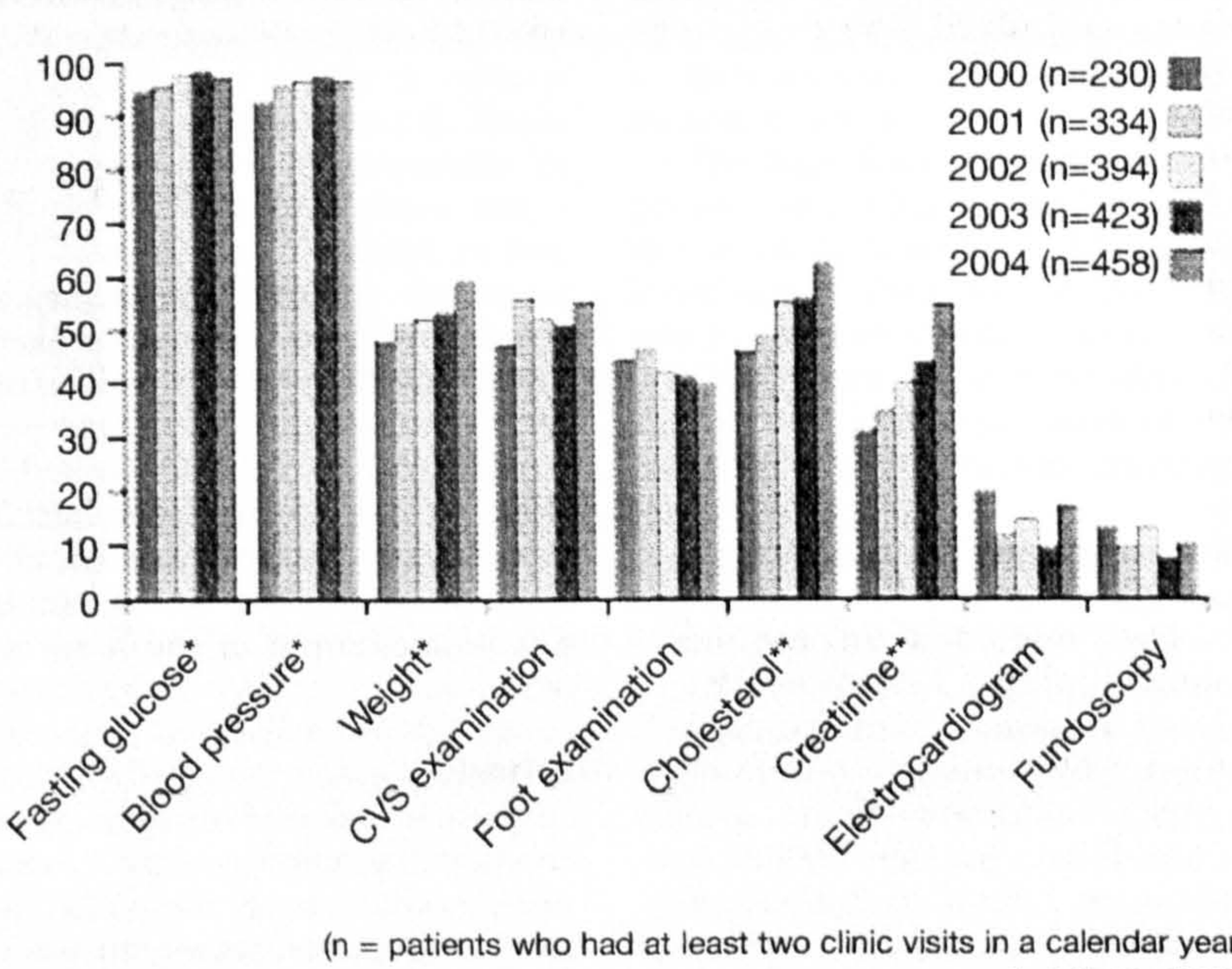
The Tunisian Ministry of Public Health granted permission for the study.

Figure 1. Process measure carried out each year (%) nationally: 2000–2002



(n = patients who had at least two clinic visits in a calendar year)
*p,0.05; **p<0.001.

Figure 2. Process measure carried out each year (%) in the south: 2000–2004



(n = patients who had at least two clinic visits in a calendar year)
*p,0.05; **p<0.001.

Statistical analysis

The process and outcome indicators used were based on the recommendations of the National Program of Hypertension and Diabetes Management. In the process of care and treatment analysis, patients who had at least two clinic visits in a calendar year were included. The proportion of patients with a recorded process of care or being prescribed a certain medication was compared for each year using the chi-squared test for trend.

Outcomes of care variables were compared in patients who had at least one result noted each year of the study period (i.e. 2000–2002 in the national cohort and 2000–2004 in the southern cohort) using the ANOVA test for repeated measures. All analyses were performed using the Statistical Package for Social Sciences software(SPSS version 12.0.1 for Windows, SAS Institute, Cary, NC, USA).

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Table 1. Trend of outcomes of the national cohort, 2000–2

	No.	Mean 2000	Mean 2001	Mean 2002	f statistic	p-value*
Fasting glucose (mmol/L)	668	10.35	10.21	10.13	5.157	0.076
Total cholesterol (mmol/L)	95	5.31	5.37	5.39	0.219	0.641
SBP (mmHg)	720	142.05	143.86	142.10	0.006	0.937
DBP (mmHg)	720	81.18	82.40	81.83	3.083	0.080
BMI (kg/m^2)	207	28.88	28.76	28.36	23.671	<0.001

*ANOVA test for repeated measures. SBP: systolic blood pressure; DBP: diastolic blood pressure; BMI: body mass index.

Table 2. Trend of outcomes of the southern cohort, 2000–4

	No.	Mean 2000	Mean 2001	Mean 2002	Mean 2003	Mean 2004	f statistic	p-value*
Fasting glucose (mmol/L)	185	10.47	10.24	10.18	9.82	10.03	4.741	0.031
Total cholesterol (mmol/L)	23	5.45	5.41	5.41	5.09	5.29	1.323	0.262
SBP (mmHg)	188	143.50	145.17	143.57	142.87	143.63	0.425	0.515
DBP (mmHg)	188	80.72	81.17	80.98	79.34	79.96	4.873	0.028
BMI (kg/m^2)	56	30.59	30.78	30.23	30.33	30.12	7.721	0.007

*ANOVA test for repeated measures. SBP: systolic blood pressure; DBP: diastolic blood pressure; BMI: body mass index.

Results

Retrospective case note examination was conducted in 34 health centres in the north and central regions of the country in 2003 and 2004, and in 14 health centres in the south of the country in 2005. In all, 2030 patients with type 2 diabetes were selected for medical record review; the mean age of patients in the national study was 62.1 years (men 61.8; women 62.2), the mean duration of diabetes was 8.5 years (men 8.3; women 8.6), and the ratio of women to men was almost 2:1 (63.0% female). The cohort from the south of the country included 593 patients with a mean age of 62.9 years (men 63.2; women 62.7), mean duration of diabetes of 9.2 years (men 9.2; women 9.1), and 61% were female.

Figures 1 and 2 show the comparison of process of care measures in the national and southern cohorts for patients who had at least two clinic visits in a calendar year. Nationally, there has been an improvement that reaches statistical significance in the majority of cases, in the recording of care of all variables measured with the notable exceptions of electrocardiograms and eye examinations. This trend continues up to 2004 in the southern cohort with the exception of the clinical examinations of the foot and cardiovascular system.

Trends in outcomes measures in the national and southern cohorts are shown in Tables 1 and 2. There were significant improvements in body mass index and there was a trend towards improvement in fasting glucose level in the three-year period nationally. Over the longer time period of the southern cohort, there were significant improvements in body mass index, fasting glucose and diastolic blood pressure.

Table 3 shows the proportion of patients being prescribed medications for diabetes, hypertension and hypercholesterolaemia in the national cohort of patients. There were significant increases in the proportion of patients being prescribed insulin, lipid-lowering agents and ACE inhibitors. Similar results were found in the southern cohort (data not shown).

Discussion

We have demonstrated a possible trend in improvements in the quality of care, based on both processes and outcomes, of patients with diabetes managed in the primary care setting in Tunisia over a three-year period from 2000 to 2002. This trend seems to have continued up to 2004 in a subset of patients from the south of the country. Our study is one of the first to look at a nationwide sample of diabetes care in a low to middle income country.

The high female to male ratio of patients attending for diabetes care in our study is striking. The prevalence rate in Tunisia is similar,[12] but other recent studies have also shown a higher rate of consultation of women.[16,18] The implication of this disparity justifies further investigation.

The number of patients attending at least twice in each calendar year is low (see legends in Figures 1 and 2) considering that the National Program of Diabetes and Hypertension Management recommends three-monthly consultations.[14] This may be partly due to poor attendance, but it is important to note that Tunisia has a mixed public/private health care system and many patients attend private care, hospitals or other institutions in addition to primary care health centres. Patients may also have moved or died during the study period.

Processes of care

With the exception of electrocardiogram and eye examinations, all processes of care measures have

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improved, most reaching statistical significance. This is true for the national sample and for the subset studied up to 2004. The recording of most measures was higher in the southern subset than in the national cohort. It has been noted previously that there are wide variations in quality across the regions of Tunisia and further work is underway to explore possible explanations.[16]

The higher rates of recording blood pressure and fasting glucose were expected, as they are required three-monthly within the national programme, whereas the other measurements are recommended annually. A plateau effect would be expected once the results were nearing to 100% and this seems to have occurred in the southern subset in the last two years of the study.

Our results compare favourably with studies from similar countries,[1–3] particularly regarding examinations undertaken on site at the health centre (blood pressure recording, weight, foot and cardiovascular examinations). Indeed, studies from Western countries such as the United Kingdom, the United States and Australia show similar results for these data.[4–6]

However, the standard of care of patients with diabetes in Tunisia has room for improvement. Regarding the measurements requiring a blood test, it is interesting to note that although nearly all patients have their fasting glucose assessed, far fewer also have a creatinine and cholesterol measurement. This may be due to the clinician not requesting the recommended tests or due to the lack of availability locally as often health centres have facilities for measuring glucose only. The low number of electrocardiogram and eye examinations recorded and the lack of signs of improvement over the study period are disappointing. It may be due to missing information, or to the long distances that some patients, many of them poor, have to travel to have these examinations performed. Measures are currently underway to improve the situation, such as training general practitioners to perform fundoscopy on site instead of patients being referred to a hospital-based ophthalmologist. The lack of continued improvement in recording of foot and cardiovascular examinations in the subset up to 2004 is also noteworthy and further exploration is warranted.

Table 3. The proportion of patients being prescribed medications from the national cohort, 2000–2.

Treatment	2000 (n=877)	2001 (n=1197)	2002 (n=1433)	p-value*
Diet only	2.4%	2.6%	3.2%	0.22
Oral antidiabetic agents	91.3%	91.0%	89.9%	0.24
Insulin	9.5%	11.1%	12.4%	0.03
Anti-hypertensive agents	48.2%	49.4%	49.4%	0.60
ACE inhibitor	1.9%	4.9%	7.8%	<0.001
Lipid-lowering agent	8.5%	11.9%	14.7%	<0.001

*Chi-squared test for trend.

Outcomes of care

The significant improvement in body mass index in our patients, even over a short time period of three years, suggests that patients are heeding dietary advice given to them. These improvements are contrary to the usual finding of increased weight over time in patients with diabetes.[11] Although it is unfortunate that measurement of HbA1c is not yet widely available within the primary care setting, it has been suggested that where resources are short, glucose testing is a reliable indicator of poor control that can be used to modify treatment safely.[19] The significant improvements in fasting glucose and diastolic blood pressure over the study period are encouraging, although the lack of similar improvement in systolic blood pressure and cholesterol suggests that more needs to be done to control these risk factors. One half of patients in our study are being prescribed anti-hypertensive agents which suggests that further therapeutic intensification is required, particularly in the light of the recently published ASCOT study that demonstrated that 78% of patients with hypertension require at least three types of medication to achieve good control.[20] Although one in six of our patients are being prescribed lipid-lowering agents, these are not always available free-of-charge and this may explain the lack of improvement of mean cholesterol.

Medications prescribed

Significant changes in prescribed medications were found despite the short timeframe. The increase in patients prescribed insulin may be due to improved therapeutic intervention by clinicians. The significant increases in the proportion of patients prescribed lipid-lowering medications and ACE inhibitors suggest that primary care clinicians in Tunisia are following worldwide guidelines on diabetes management. It may also be due to improved availability of these medications within the primary care setting as part of the national programme. The proportion of patients prescribed lipid-lowering medications and ACE inhibitors has been used elsewhere by researchers as quality indicators of diabetes management.[21] These findings therefore support the results of the process and outcome measures in suggesting a general improvement in the quality of care of patients with diabetes in Tunisia.

Strengths and limitations of the study

The strengths of this observational study lie in the fact that it is a relatively large, random sample covering the whole of the country. However, the data are limited to patients who attended primary care facilities in the years studied, and therefore we can assert only that there appears to be a trend in improvements in the quality of care. The outcome of care analysis uses repeated measures data to exclude any potential bias caused by patient differences. The consequence of using the data from only the cohort of patients with available

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results in every consecutive year is that the final patient numbers are relatively small compared to the initial set. It was thought that repeated measures data were not necessary for the process of care analysis as patient differences may explain outcome differences, but ought not to cause differences in recording of data. Patients attending less than twice a year were excluded as they were likely to be simultaneously attending other health care institutions, such as private care or secondary care facilities, and the aim of our study was to assess improvements in care in primary care centres only. The short study period of the national cohort is a limitation that we addressed by collecting data from a smaller cohort for a longer time period.

Quality of health care is a multidimensional concept that has been identified as including a combination of access (assessed in our study by processes of care) and effectiveness (assessed by outcomes of care). We have used a combination of both process and outcome measures, along with medication prescribed, in order to give a more accurate overall picture of quality of care. However, we acknowledge that the recording of care does not necessarily relate to what is done, i.e. it is possible that the observed improvements in processes of care are simply due to improved documentation. If so, the improved recording of care has benefits apart from improved quality of care for the patients, such as the potential for audit and evaluation. We also acknowledge that the outcome variables are intermediate and not long term; it is not possible at present to identify long-term outcomes in Tunisia, such as complication and mortality rates.

Conclusion

So why has the quality of care improved? It may be due to one or more of the components of the National Program of Hypertension and Diabetes Management, such as professional training, patient education or the use of standardised medical records and chronic disease clinics. Equally, there has been a steady advance in socio-economic conditions in Tunisia that may have may have facilitated these improvements. Systematic reviews of interventions to improve the management of diabetes in primary care have been reported. A review by Renders *et al.* in 2001[10] concluded that both professional and organisational interventions improved process of care, but complex interventions, that included patient education or the enhanced role of the nurse, led to improved outcomes as well as processes. The most recent systematic review was published in 2004 by the US Agency for Healthcare Research and Quality.[22] Their conclusion was that no one particular type of quality intervention had an advantage over others, but employing two or more strategies was more successful than single interventions. Further qualitative and quantitative work is now underway in Tunisia to investigate causes of the improvements found in our study.

The wider implications of our study are that improvements in the quality of care can be achieved even in low to middle income countries, which may not have the resources to purchase expensive equipment such as computer systems.

Key points

- There has been a trend in improvement in the quality of care, based on both processes and outcomes and treatment, of patients with diabetes managed in the primary care setting in Tunisia since 2000
- These improvements have coincided with the introduction of a National Program of Hypertension and Diabetes Management
- Improvements in the quality of care can be achieved even in low to middle income countries, which may not have the resources to purchase expensive equipment such as computer systems

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Conflict of interest statement

There are no conflicts of interest.

References

1. Gulliford MC, Mahabir D, Ukoumunne OC. Evaluating variations in medical practice between government primary care health centres. *J Clin Epidemiol* 2001; **54:** 511–517.
2. NHS Health and Social Care Information Centre. Quality and Outcomes Framework Information: 2004/5 data. http://www.icservices.nhs.uk/qofdocuments/data [accessed 5 Feb 2006].
3. Reed RL, Revel AD, Carter AO, *et al.* A controlled before-after trial of structured diabetes care in primary health centres in a newly developed country. *Int J Qual Health Care* 2005; **17:** 281–286.
4. Campbell SM, Roland MO, Middleton E, *et al.* Improvements in quality of clinical care in English general practice 1998–2003: longitudinal observational study. *BMJ* 2005; **331:** 1121–1125.
5. Arday DR, Fleming BB, Keller DK, *et al.* Variation in diabetes care among states. *Diabetes Care* 2002; **25:** 2230–2237.
6. Nagpal J, Bhartia A. Quality of diabetes care in the middle- and high-income group populace. *Diabetes Care* 2006; **29:** 2341–2348.
7. UK Prospective Diabetes Study Group. Intensive blood glucose control with sulphonylureas or insulin compared with conventional therapy and risk of complications in patients with type 2 diabetes: UKPDS 34. *Lancet* 1998; **352:** 854–865.
8. UK Prospective Diabetes Study Group. Tight blood pressure and risk of microvascular and macrovascular complications of type II diabetes: UKPDS 38. *BMJ* 1998; **317:** 701–713.
9. Griffin S, Kinmonth AL. Diabetes care: the effectiveness of systems for routine surveillance for people with diabetes (Cochrane Review). The Cochrane Library Issue 2. Oxford: Update Software, 1999.
10. Renders CM, Valk GD, Griffin SJ, *et al.* Interventions to improve the management of diabetes in primary care, outpatient and community settings: A systematic review. *Diabetes Care* 2001; **24:** 1821–1833.
11. Coppell KJ, Anderson K, Williams S, *et al.* Evaluation of diabetes care in the Otago region using a diabetes register, 1998–2003. *Diab Res Clin Pract* 2006; **71:** 345–352.

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12. Bouguerra R, Alberti H, Ben Salem L, *et al.* The Global Diabetes Pandemic: The Tunisian experience. *Eur J Clin Nutr* (in press).
13. *Preventing chronic diseases, a vital investment. A WHO global report.* World Health Organization, 2005.
14. *Programme National de Prise en Charge des Diabétiques dans les Structures de 1ère Ligne.* Ministère Tunisien de la Santé Publique, January 2001.
15. Alberti HP, Boudriga N, Nabli M. Primary Care in Tunisia; improving diabetes management. *Diabetes Voice* 2003; 48: 21–23.
16. Alberti H, Boudriga N, Nabli M. The factors affecting the quality of diabetes care in primary health care centres in Tunis. *Diab Res Clin Pract* 2005; 68: 237–243.
17. Roper NA, Bilous RW, Kelly WF, *et al.* Cause-specific mortality in a population with diabetes. *Diabetes Care* 2002; 25: 43–48.
18. Yount KM, Agree EM, Rebellon C. Gender and use of health care among older adults in Egypt and Tunisia. *Soc Sci Med* 2004; 59: 2479–2497.
19. Rotchford AP, Rotchford KM, Machattie T, *et al.* Assessing diabetic control – reliability of methods available in resource poor settings. *Diabetic Med* 2002; 19: 195–200.
20. Dahlof B, Sever PS, Poulter NR, *et al*, for the ASCOT Investigators. Prevention of cardiovascular events with an anti-hypertensive regime of amlodipine adding perindopril as required *vs.* atenolol adding bendroflumethazide as required, in the Anglo-Scandinavian Outcomes Trial – Blood-Pressure-Lowering Arm (ASCOT-BPLA): a multi-centre randomised controlled trial. *Lancet* 2005; 366: 389–396.
21. Campbell SM, Roland MO, Shekelle PG, *et al.* The development of review criteria for assessing the quality of management of stable angina, adult asthma and non insulin dependent diabetes mellitus in general practice. *Qual Health Care* 1999; 8: 6–15.
22. Shojania KG, Ranji SR, Shaw LK, *et al. Closing the quality gap: A critical analysis of quality improvement strategies, Vol 2: Diabetes Mellitus Care. Technical Review 9.* Rockville, MD: Agency for Healthcare Research and Quality, September 2004.

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ORIGINAL ARTICLE

"Damm Sokkor" Factors Associated With the Quality of Care of Patients With Diabetes

A study in primary care in Tunisia

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OBJECTIVE — To identify the organizational, physician, and patient factors associated with the quality of care of patients with diabetes in a low-/middle-income country.

RESEARCH DESIGN AND METHODS — Data from 2,160 randomly selected patients with diabetes were extracted from the manual medical records of a nationwide sample of 48 randomly selected health centers. Physician and organizational characteristics were collected from national reports, questionnaires, interviews, and observation at the centers. Univariate and multivariate regression analyses were undertaken to identify associations with four quality-of-care scores, based on processes and intermediate outcomes of care and 53 potential explanatory factors.

RESULTS — The mean age of the study population was 62.4 years, mean duration of diabetes was 8.4years, 62% were female, and 94% had type 2 diabetes. In the final multivariate models, factors independently and significantly associated with higher process-of-care scores were regional affluence, doctor motivation, and the use of chronic disease clinics ($P < 0.05$). Health centers with younger patients and increased availability of medication were independently and significantly associated with improved outcome-of-care scores ($P < 0.05$). The final models of the four quality-of-care scores explained 55–71% of the variations in scores.

CONCLUSIONS — Use of chronic disease clinics, availability of medication, and possibly doctor motivation, appear to be the most strongly related modifiable factors influencing diabetes care. These findings will be used to develop and implement culturally appropriate quality improvement interventions to improve the quality of diabetes care. We recommend our findings be taken into account in other low-/middle-income countries.

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Worldwide, the quality of care of patients with diabetes has been shown to be variable and suboptimal (1–6), despite the evidence that good control of blood pressure and glucose significantly reduces the risk of cardiovascular and microvascular complications (7,8). The management of diabetes is acknowledged to be complex. The quality of diabetes care can be influenced by patient, health professional, and organizational factors (9–11). Commonly reported patient factors are adherence, attendance, and education together with individual characteristics such as age, sex, and presence of comorbidity (11–14). Health physician factors include the number, training, and sex of the treating physician and practice team; the role of clinical inertia; and the clinician/patient relationship (10,12,15–18). Many organizational factors have been shown to influence care such as the use of structured diabetes clinics, recall systems, practice guidelines, and educational programs (14,19).

Very few studies on the factors influencing the care of patients with diabetes have been reported from low-/middle-income countries, despite the fact that 80% of all chronic disease deaths worldwide now occur in such countries (20). None, to our knowledge, have used a nationwide sample from primary care, where most patients with diabetes are managed. It is crucial that quality improvement efforts are underpinned by more specific knowledge of modifiable factors amenable to change in order to efficiently target improvement strategies, particularly in resource-limited settings.

Tunisia, a low-/middle-income country, is experiencing a major increase in noncommunicable diseases such as diabetes (21). In response, the Tunisian Ministry of Health have initiated a national program of diabetes management within primary care with the aim of improving the quality of care (22); the program was initiated in 1993 and extended to the whole country in 1998. The program incorporates teaching of primary health care doctors and the use of national, standardized protocols, disease registers and disease-specific medical records. There has also been an emphasis on patient education, prioritizing the availability of medications for chronic diseases and introducing weekly chronic disease clinics.

We sought to identify the patient, physician, and organizational factors that are associated with the quality of care of patients with diabetes using Tunisia as an illustrative example of a low-/middle-income country.

RESEARCH DESIGN AND METHODS

— Tunisia is a country of 10 million inhabitants, situated on the North African coast. There are ~2,000

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A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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Table 1—*Explanatory variables included in the analysis*

Patient variables (n = 21)	Health professional variables (n = 9)	Organizational variables (n = 23)
Age	Interest in diabetes of clinicians*	Urban/rural health centre
Sex	Training of clinicians†	Size of health centre‡
Type of diabetes	Gender of clinicians	Frequency of medical clinics
Family history of diabetes	Number of clinicians	Distance from capital city
Schooling level	Motivation of clinicians	Affluence of region§
Poverty‖	Workload of clinicians¶	Motivation of the regional director
Employment	Time commitment of clinicians	Distance from secondary care
Distance of residence from centre	Nutritionist available	Number of patients (total and diabetic)
Marital status	Number of nurses	Proportion of patients with diabetes
Duration of diabetes		Presence and use of new disease-specific medical records
Insulin treatment		Use of disease register and patient-held records
Attendance issues (based on four indicators)**		Availability of medication††
Compliance with treatment††		Affluence of the patients attending the centre**
Smoking		Presence and use of chronic disease clinics
Alcohol consumption		Equipment (based on four indicators)‡‡
Associated illnesses (cardiovascular disease, renal disease, and dyslipid.)		Patient education sessions

Data used for variables: *Interest in diabetes of clinician (presence of a regional coordinator of the national program). †Training of clinicians (attendance at postgraduate training in diabetes). ‡Size of health centre (based on Ministry of Health classification). §Affluence of region (based on United Nations regional poverty indicators). ‖Poverty and affluence of patients (based on health insurance coverage). ¶Workload of clinicians (average number of patients per clinic). **Four indicators of attendance (nonattendees, frequency of attendance, frequency of appointments, and late attendees). ††Compliance with treatment (as indicated by clinician in medical records). ‡‡Availability of medication (based on discussions with the health center staff). §§Four equipment indicators (presence of an electrocardiogram machine, a glucometer, and a means for measuring height and weight). §§Motivation of clinicians and regional directors (assigned a score based on discussions and observations in line with the "theory of planned behavior" in which motivation [intention] is influenced by three variables: the degree of control an individual feels they have over a behavior, attitudes towards the behavior, and subjective norms [31]).

public-sector, primary care health centers situated throughout the 24 regions of the country. The majority of these centers are small, nurse-ran health posts that do not manage patients with chronic diseases; we therefore chose to include only health centers that hold medical consultations four or more times a week (n = 567). Two health centers were randomly selected from each region using data obtained from the Ministry of Public Health.

Patient data were extracted from manual medical records. A maximum of 50 patients with diabetes were randomly selected per health center. Patient details included demographic data, clinical background, processes of care (i.e., whether a measurement had been recorded in a 12-month period), outcomes of care (i.e., the result of the measurement), and prescriptions of blood glucose–lowering, antihypertensive, and lipid-lowering medication. Physician and organizational characteristics were collected from national and health center reports, a structured questionnaire administered at each center and interviews with the staff at the health centers. Explanatory factors were selected on the basis of research findings elsewhere and exploratory qualitative work in Tunisia (23) (Table 1).

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Quality-of-care measures

The quality-of-care indicators were based on two process-of-care scores and two outcome-of-care scores. The process-of-care scores were calculated based on recommendations from the Tunisian national program (21), namely assessments of fasting glucose, blood pressure, weight, total cholesterol, creatinine, foot examination, cardiovascular examination, electrocardiogram, eye examination, and A1C. The latter four tests usually require referral to a local hospital, as they cannot be performed on site at the health center. Following a model proposed by Gulliford et al. (4) in Trinidad and Tobago, we combined the process-of-care results to create two quality-of-care scores.

Nonweighted process-of-care score. Nonweighted process-of-care scores were obtained by assigning to each patient a score of 1 for each measurement undertaken in the previous 12-month period (maximum score: 10).

Weighted process of care score. To take into account the importance of glycemic and blood pressure control, a score was calculated in which glucose and blood pressure measurement were given a weighted score of 4 rather than 1; the other measurements remained with a score of 1 (maximum score: 16). The outcome-of-care scores were based on levels of fasting glucose, blood pressure, total cholesterol, and BMI. The assessment was based on an average of all the results collected per patient.

Four-variable outcome-of-care score. An outcome-of-care score was calculated based on how many of the following targets a patient achieved: blood pressure <140/80 mmHg, fasting glucose ≤7.8 mmol/l, total cholesterol ≤5 mmol/l, and BMI ≤25 kg/m^2 (24). Missing data were excluded. A score was assigned to each patient based on the proportion of targets achieved.

Two-variable outcome-of-care score. A second outcome-of-care score was calculated using fasting glucose and blood pressure levels only. The scoring system used a range from good control (using definitions above), borderline control, and poor control (defined as blood pressure ≥160/95 mmHg and fasting glucose ≥11.1 mmol/l). Each patient was assigned a score of 2 for good control, 1 for borderline control, and 0 for poor control for both fasting glucose and blood pressure using a denominator of two (if only one variable recorded) or four (if both variables recorded). A mean of each of the four scores was calculated for each health

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Table 2—*Patient characteristics* (n = 2,160)

	Means ± SD	Percentage	(95% CI)	Data available
Age (years)	59.9 ± 14.1			2109
Duration of diabetes (years)	8.6 ± 6.3			1469
Mean fasting glucose (mmol/l)	10.2 ± 2.9			2071
Mean SBP (mmHg)	139 ± 18			2060
Mean DBP (mmHg)	80 ± 9			2059
Mean total cholesterol (mmol/l)	4.9 ± 1.0			1520
Mean creatinine (μmol/l)	85 ± 29			1027
Mean BMI (kg/m^2)	27.9 ± 5.1			819
Mean A1C (%)	8.9 ± 2.4			171
Women		61.8	58.1–65.4	2160
Married		77.0	73.7–80.3	1487
No formal education <14 years		64.1	57.0–71.2	1025
Type 2 diabetes		94.0	91.8–96.2	2160
Positive family history of diabetes		53.7	48.3–59.1	1311
Smoking		19.8	16.1–23.6	1223
Associated illnesses (cardiovascular disease)		7.7	3.9–11.5	1273
Associated illnesses (renal disease)		5.8	3.7–7.8	1229
Associated illnesses (dyslipid)		8.4	5.1–11.7	1195
Treatment*				
No glucose-lowering medication		4.4	3.2–5.6	2160
Blood glucose–lowering drugs		86.0	83.2–88.8	2160
Insulin (alone or with oral agents)		19.1	15.4–22.9	2160
Antihypertensive drugs		50.3	47.2–53.4	2160
Lipid-lowering drugs		15.6	12.8–18.4	2160

*Treatment is treatment prescribed on last documented visit.

center. The scores were assessed for normality, and the value of Cronbach's α was calculated to measure the internal consistency of each score.

Statistical analysis

The health center was used as the unit of randomization in order to cluster patients into practices, as recommended in primary care studies (25). All explanatory variables were first tested against each of the outcome variables (quality-of-care scores) using ANOVA (categorical variables) or linear regression (continuous variables). Logarithmic transformations were made for variables not normally distributed; if the variable remained not normally distributed, the variable was converted into a categorical variable. Analyses were weighted for number of patients per center and date of data collection. Potentially significant variables ($P < 0.15$) were entered into three separate multilinear regression models, grouping variables into patient, health professional, or organizational with each of the outcome variables as the dependent variable. Potentially significant variables ($P < 0.15$) from each of the three separate models were then entered into a final regression model against each outcome variable. The data were analyzed using SPSS software package (version 12.0.1). Approval for the study was granted by the Tunisian Ministry of Public Health.

RESULTS — A total of 2,160 patients with diabetes were selected for medical record review from 48 health centers; the mean age of patients in the study was 62.4 years, mean duration of diabetes was 8.4 years, 62% were female, and 94% had type 2 diabetes.

A mean of 45 patients were selected per health center. The ratio of urban to rural health centers was 2:1. Health centers had a mean of 2.1 primary care doctors and 5.6 nurses, and 20% had a nutritionist available for patients with diabetes. On average, each health center served a population of 15,986 and managed 162 patients with diabetes, and 26 patients attended per clinic per doctor. Among the 48 health centers, 85% had the new disease-specific medical records available, 70% had a chronic disease register, 63% used patient-held records, 79% had a weekly chronic disease clinic, 39% had an electrocardiogram machine on site, 93% had a glucometer on site, and 57% ran regular patient education sessions. Table 2 depicts selected patient characteristics, and Table 3 depicts the results of the process and intermediate outcomes of care of the study population. All four quality-of-care scores were normally distributed. Internal consistency was high for the process-of-care scores (0.84 and 0.81) but lower for the outcome-of-care scores (0.58 and 0.29) due to the lower number of variables incorporated.

Multivariate linear regression analyses

Univariate analysis demonstrated a potential association among 16, 18, 13, and 11 of 53 explanatory factors with the four quality-of-care indicators (nonweighted process-of-care, weighted process-of-care, four-variable outcome-of-care, and two-variable outcome-of-care scores, respectively; online appendix [available at http://care.diabetesjournals.org]). All factors potentially related to each quality-of-care indicator were entered into the three separate multilinear regression models, grouping factors into patient, health professional, or organizational. Factors that remained potentially significant were entered into a final regression model for each indicator, and these are demonstrated in Table 4. The final models explained 71.3% (nonweighted process-of-care score), 62.7% (weighted process-of-care score), 64.4% (four-variable outcome-of-care score), and 55.9% (two-variable outcome-of-care score) of the variations in scores.

CONCLUSIONS — We report the first nationwide study from primary care of the factors that influence the care of patients with diabetes from a low-/middle-income country. Use of chronic disease clinics, availability of medication, and doctor motivation appear to be the most strongly related modifiable factors influencing diabetes care in our context. The other factors that were independently and significantly associated with improved processes or outcomes of care were regional affluence and younger age.

Standards of care

The process-of-care results show that the majority of patients are having their blood pressure and fasting glucose recorded annually. These results compare favorably with studies from similar countries (4–6,26,27). Around half of the patients have

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Table 3—*Processes and intermediate outcomes of care*

	Percentage	*n**	Range (%)†
Processes of care (n = 2,160)			
Fasting glucose	88.8	1,687	15.4–100
Blood pressure	91.7	1,741	46.2–100
Weight	53.3	1,013	0–100
CVS examination	55.5	1,053	0–100
Foot examination	44.5	846	0–100
Cholesterol	48.6	923	0–95.7
Creatinine	32.9	625	0–97.8
Electrocardiogram	16.9	321	0–82.6
Fundoscopy	10.8	205	0–60.9
A1C	4.5	86	0–71.8
Outcomes of care			
Fasting glucose ≤7.8 mmol/l	24.6	455/1,785	4.9–47.2
Blood pressure ≤140/80 mmHg	66.9	1,270/1,898	34.4–91.4
Total cholesterol ≤5 mmol/l	56.2	668/1,189	20–87.5
BMI ≤25 kg/m^2	28.7	189/659	9.1–62.5

* Number of patients (total is 2,160, unless otherwise stated). †Range is lowest and highest health centre percentage. For the outcomes of care, health centers with ≤10 patients with measurements undertaken were excluded. Processes of care are the percentage and number of patients having a measure undertaken in the preceding 12 months, of those who attended the health center at least once. Intermediate outcomes of care are the percentage and number of patients reaching targets based on an average measurement, including only patients with at least one measurement available.

most of the other measures performed annually. Fewer patients are recorded as having an electrocardiogarm, eye examination, and A1C measurement. The latter is almost certainly due to the fact that this test is not generally available within primary care. The low recording of eye and electrocardiogram examinations may be due to the fact that these tests are usually performed in secondary care; primary care physicians report difficulties in persuading patients to attend and in receiving the results from secondary care. Since the time of the study, training of primary care doctors in the use of ophthalmoscopes has been introduced, and it is hoped that this will improve the uptake of eye examinations. Particularly striking is the variation in results between health centers as has been demonstrated in other countries (3,4). The percentage of patients achieving targets of blood pressure, fasting glucose, and cholesterol is variable and suboptimal but again compares favorably with results from other countries (4,5,26).

Factors associated with improved quality of care

Assessing the relative influence of specific factors that influence diabetes care is essential for the development of targeted interventions to improve the quality of care. Our study showed five factors to be clearly associated with improved processes or outcomes of care: regional affluence, doctor motivation, use of chronic disease clinics (processes), younger age, and increased availability of medication (outcomes).

An association between affluence and quality of care has been demonstrated previously in studies from the developed world (11,28), and it appears that this influence is equally important in less affluent countries. Financial aspects strongly influence the care of patients, especially those with chronic diseases, from developing nations (29).

The significant influence of doctor motivation is perhaps unexpected. Historically, more emphasis has been placed on the training and education of clinicians rather than their attitudes and beliefs, but motivation of the health professionals is increasingly being recognized as having as central role in diabetes care (12). However, this finding must be approached with caution given the subjective nature of the term "motivation," even within the context of a theoretical model (30), and the subjective method of data collection (interviews and observations). Further investigation is required using more formal methods, such as validated questionnaires or surveys, to confirm this potential discovery. The introduction of weekly chronic disease clinics at most of the health centers studied seems to have been a major success in improving the quality of diabetes care in Tunisia. Structured care in the primary care setting has been shown in systematic reviews from developed nations to be associated with improved quality (19), and our findings suggest that these results can be generalized to less affluent nations. The association of younger age with improved outcomes of care seems to be related to the inclusion of BMI and cholesterol in the four-variable outcome-of-care score. A national nutrition survey in Tunisia 10 years ago demonstrated the association of age with BMI and cholesterol in Tunisia, as in other countries (31).

Finally, the association of improved outcomes of care at health centers with increased availability of medication suggests a direct link between intermediate patient outcomes and medication availability. In the Tunisian public sector, medications are free with the payment of a small consultation fee. If the medications are unavailable, patients are required to buy them privately from pharmacists, and many cannot afford to do so. Other authors from developing nations have stressed the essential role of the provision of medication (29,32). One of the aims of the Tunisian national program has been to prioritize the supply of medicines for chronic diseases, and our evidence supports this initiative.

Quality-of-care indicators

Quality of health care is a multidimensional concept that has been identified as including a combination of access (assessed in our study by processes of care) and effectiveness (assessed by outcomes of care) (33). Much debate has centered on the use of processes or outcomes to assess quality of care (34). We chose to use a combination of process and outcome measures in an attempt to give a more accurate overall picture of the factors influencing both the recording of care and the achievement of clinical outcomes. We recognize that our outcome variables are intermediate and not long term; it is not possible at present to identify long-term outcomes, such as complication and mortality rates, in our setting.

Strengths and weaknesses of the study

Our study is the first nationwide study from primary care on the factors that influence diabetes care from a low-/middle-income country to be reported. In addition, it is one of the first to incorporate an extensive number and range of po-

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Table 4—*Final multivariate regression models of factors associated with process and outcome of care scores*

Independent variable	Factor	β Coefficient (standardised)	95% CI	Significance
Nonweighted process of care score				
Motivation of clinicians	Health professional	0.55	−0.05 to 2.21	0.06
Regional affluence	Organizational	0.51	−0.54 to 0.07	0.11
Use of chronic disease clinics	Organizational	0.17	−0.04 to 0.06	0.59
Punctuality of attendance	Patient	0.10	0.08 to −0.06	0.73
Use of patient held records	Orgainzational	0.05	−1.45 to 1.78	0.82
Type 1 diabetes*	Patient	0.03	−7.50 to 6.58	0.92
Weighted process of care score				
Regional affluence	Organizational	0.51	0.12 to 0.53	0.003
Motivation of doctors	Health professional	0.37	0.22 to 1.68	0.013
Use of chronic disease clinics	Organizational	0.36	0.01 to 0.70	0.029
Family history of diabetes	Patient	0.22	−0.01 to 0.05	0.10
Presence of a nutritionist	Health professional	0.05	−1.16 to 1.66	0.72
Punctuality of attendance	Patient	0.02	−0.05 to 0.06	0.91
Four-variable outcome-of-care score				
Younger age	Patient	0.35	0.00 to 0.18	0.016
Availability of medication	Organizational	0.27	0.00 to 0.60	0.04
Lower number of patients*	Organizational	0.23	−45.1 to 660.1	0.09
Presence of new disease-specific medical records	Organizational	0.10	0.03 to 0.11	0.23
Sex (male)	Patient	0.18	0.00 to 0.01	0.25
Two-variable outcome-of-care score				
Smaller health centres	Organizational	0.43	−0.09 to 0.04	0.37
Patient education sessions	Organizational	0.28	−0.11 to 0.21	0.48
Use of disease-specific medical records	Organizational	0.33	−0.05 to 0.03	0.51
No comorbidity of dyslipidaemia*	Patient	0.20	−0.65 to 0.98	0.65
Presence of disease-specific medical records	Organizational	0.16	−0.18 to 0.27	0.68
Lower number of doctors	Health professional	0.14	−0.06 to 0.08	0.74
Presence of a nutritionist	Health professional	−0.07	−0.28 to 0.25	0.89

*Logarithmic transformation used for these variables. All models were weighted for the number of patients per center (using the WLS option in SPSS) and included time of visit to the center as a potential confounding factor. Nonweighted process-of-care score is the proportion of 10 measures patients have had undertaken in the preceding 12 months. The weighted process-of-care score assigns a weight of four to blood pressure and fasting glucose measurements and one to the other eight measures. The four-variable outcome-of-care score is based on achieving targets for fasting glucose, blood pressure, total cholesterol, and BMI. The two-variable outcome-of-care score is based on achieving low and high targets for blood pressure and fasting glucose only.

tential variables, including patient, health professional, and organizational factors. Selection of the variables was based on exploratory, qualitative work from Tunisia (23) in addition to reported findings from elsewhere. Our inclusion of >50 potential factors, though larger than previous studies, is not exhaustive, and other unexplored factors may be playing a role. However, it is reassuring to note that our final models did explain most of the variations in quality scores observed. Certain explanatory variables could be subject to bias; for example, availability of medication was based on reports from staff rather than an objective measure.

Based on a two-stage randomized procedure, our study is nationally representative of the public sector primary care management of patients with diabetes, covering >150,000 patients throughout the country. It is possible that some of the factors discovered may be contextual and not transferable to other settings. Nonetheless, being one of the first and largest studies to be reported from a low-/middle-income country, we would suggest that our findings are more likely to be relevant to other similar countries than previous work from developed nations.

In summary, we found the use of chronic disease clinics, the availability of medication, and possibly, doctor motivation to be the most strongly related modifiable factors influencing the quality of diabetes care in the Tunisian primary care setting. We suggest that our findings be evaluated in other settings. However, it is unlikely that such a large, encompassing study can be undertaken in every context, particularly in less affluent nations. We would therefore recommend that clinicians, managers, and health policymakers take our results into consideration in order to develop and implement culturally appropriate quality improvement interventions in other low-/middle-income countries.

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References

1. Saaddine JB, Cadwell B, Gregg EW, Engelgau MM, Vinicor FF, Imperatore G, Narayan KM: Improvements in diabetes processes of care and intermediate outcomes: United States, 1988–2002. *Ann Intern Med* 144:465–477, 2006

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2. Campbell SM, Roland MO, Middleton E, Reeves D: Improvements in quality of clinical care in English general practice 1998–2003: longitudinal observational study. *BMJ* 331:1121–1125, 2005
3. Arday DR, Fleming BB, Keller DK, Pendergrass PW, Vaughn RJ, Turpin JM, Nicewander DA: Variation in diabetes care among states. *Diabetes Care* 25: 2230–2237, 2002
4. Gulliford MC, Mahabir D, Ukoumunne OC: Evaluating variations in medical practice between government primary care health centres. *J Clin Epidemiol* 54: 511–517, 2001
5. Nagpal J, Bhartia: A Quality of diabetes care in the middle- and high-income group populace. *Diabetes Care* 29:2341–2348, 2006
6. Reed RL, Revel AD, Carter AO, Saadi HF, Dunn EV: A controlled before-after trial of structured diabetes care in primary health centres in a newly developed country. *Int J Qual Health Care* 17:281–286, 2005
7. U.K. Prospective Diabetes Study Group: Intensive blood glucose control with sulphonylureas or insulin compared with conventional therapy and risk of complications in patients with type 2 diabetes: UKPDS 34. *Lancet* 352:854–865, 1998
8. U.K. Prospective Diabetes Study Group: Tight blood pressure and risk of microvascular and macrovascular complications of type II diabetes: UKPDS 38. *BMJ* 317:701–713, 1998
9. Brown BB, Harris SB, Webster-Bogaert S, Wetmore S, Faulds C, Stewart M: The role of patient, physician and systemic factors in the management of type 2 diabetes mellitus. *Fam Pract* 19:344–349, 2002
10. Khunti K: Use of multiple methods to determine factors affecting quality of care of patients with diabetes. *Fam Pract* 16: 489–494, 1999
11. Pringle M, Stewart-Evans C, Coupland C, Williams I, Allison S, Sterland J: Influences on control in diabetes mellitus: patient, doctor, practice or delivery of care? *BMJ* 306:630–634, 1993
12. Simmons D, Lillis S, Swan J, Haar J: Discordance in perceptions of barriers to diabetes care between patients and primary care and secondary care. *Diabetes Care* 30: 490–495, 2007
13. Clark M, Hampson SE: Comparison of patients' and health care professionals' beliefs about and attitudes toward type 2 diabetes. *Diabet Med* 20:152–154, 2003
14. Ward MM, Yankey JW, Vaughn TE, BootsMiller BJ, Flach SD, Welke KF, Penderghast JF, Perlin J, Doebbeling BN: Physician process and patient outcome measures for diabetes care: relationships to organisational characteristics. *Med Care* 42:840–850, 2004
15. Sutton M, McLean G: Determinants of primary medical care quality measured under the new UK contract: cross sectional study. *BMJ* 332:389–390, 2006
16. Pellegrini F, Belfiglio M, De Berardis G, Franciosi M, Di Nardo B, Greenfield S, Kaplan SH, Sacco M, Tognoni G, Valentini M, Corrado D, D'Ettorre A, Nicolucci A, the QuED Study Group: Role of organizational factors in poor blood pressure control in patients with type 2 diabetes. *Arch Intern Med* 163:473–480, 2003
17. Larme AC, Pugh JA: Attitudes of primary care providers toward diabetes: barriers to guideline implementation. *Diabetes Care* 21:1391–1396, 1998
18. Phillips LS, Branch WT, Cook CB, Doyle JP, El-Kebbi IM, Gallina DL, Miller CD, Ziemer DC, Barnes CS: Clinical inertia. *Ann Intern Med* 135:825–834, 2001
19. Griffin S, Kinmouth AL: Systems for routine surveillance for people with diabetes mellitus. *Nurs Times* 97:44, 2001
20. World Health Organization: *Preventing Chronic Diseases: A Vital Investment*. A World Health Organization Global Report. Geneva, World Health Org., 2006
21. Bouguerra R, Alberti H, Salem LB, Rayana CB, Atti JE, Gaigi S, Slama CB, Zouari B, Alberti K: The global diabetes pandemic: the Tunisian experience. *Eur J Clin Nutr* 61:160–165, 2007
22. Ministère de la Santé Publique: *Programme National de Prise en Charge des Diabétiques dans les Structures de 1ère Ligne*. Tunisie, 2001
23. Alberti H: "Sokkor": research into the contextual facilitators and barriers involved in the management of patients with type 2 diabetes mellitus must now intensify and extend into all cultures worldwide (Letter). *Fam Pract* 20:94, 2003
24. Diabetes U.K. *Recommendations for the Management of Diabetes in Primary Care*. 2nd ed. London, Diabetes U.K., 2000
25. Grimshaw JM, Campbell MK, Eccles MP, Steen IN: Experimental and quasi-experimental guideline implementation strategies. *Fam Pract* 17 (Suppl. 1):S11–S18, 2000
26. Akel H, Hamadeh G: Quality of diabetes care in a university health center in Lebanon. *Int J Qual Health Care* 11:517–521, 1999
27. El-Shazly M, Abdel-Fattah M, Zaki A, Bedwani R, Assad S, Tognoni G, Nicolucci A: Health care for diabetic patients in developing countries: a case from Egypt. *Public Health* 114:276–281, 2000
28. Hippisley-Cox J, O'Hanlon S, Coupland C: Association of deprivation, ethnicity, and sex with quality indicators for diabetes: population based survey of 53,000 patients in primary care. *BMJ* 329:1267–1269, 2004
29. Whiting DR, Hayes L, Unwin NC: Diabetes in Africa: challenges to health care for diabetes in Africa. *J Cardiovasc Risk* 10: 103–110, 2003
30. Armitage CJ, Conner M: Efficacy of the theory of planned behaviour: a meta-analytic review. *Br J Soc Psychol* 40:471–499, 2001
31. Bouguerra R, Ben Salem L, Alberti H, Ben Rayana C, El Khadhi A, El Alti J, Gaigi S, Ben Slana C, Zouari B: The prevalence of metabolic abnormalities in the Tunisian adult: a population based study. *Diabetes Metab* 32:215–221, 2006 AQ: C
32. De-Graft Aikins A: Healer shopping in Africa: new evidence from rural-urban qualitative study of Ghanaian diabetes experiences. *BMJ* 331:737, 2005
33. Campbell SM, Roland MO, Buetow S: Defining quality of care. *Soc Sci Med* 51: 1611–1625, 2000
34. Davies HTO, Crombie IK: Assessing the quality of care. *BMJ* 311:766, 1995 AQ: D

rich4/zdc-dcare/zdc-dcare/zdc00807/zdc6355d07a | springj | S=7 | 6/13/07 | 9:07 | doi: 10.2337/dc07-0520 | artno: 0520