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ORIGINAL RESEARCH

Turkish Insulin Injection Techniques Study: Complications of Injecting Insulin Among Turkish Patients with Diabetes, Education They Received, and the Role of Health Care Professional as Assessed by Survey Questionnaire

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ABSTRACT

Introduction: Using the Turkish and rest of world (ROW) Injection Technique Questionnaire (ITQ) data we address key insulin injection complications.
Methods: Summarized in first ITQ paper.

ITQ Turkey Study Group (see Appendix Table 15).

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Results: Nearly one-third of Turkish insulin users described lesions consistent with lipohypertrophy (LH) at their injection sites and 27.4% were found to have LH by the examining nurse (using visual inspection and palpation). LH lesions in the abdomen and thigh of Turkish patients are slightly smaller than those measured in ROW but more than half of Turkish patients who have LH continue to inject into them at least daily. More than a quarter of Turkish patients have frequent unexplained hypoglycemia and nearly 2 out of 5 have glycemic variability, both of which have been linked to the presence of LH and the habit of injecting into it. Nearly half of Turkish injectors

report having pain on injection. Of these, just over half report having painful injections only several times a month or year (i.e., not with every injection). In Turkey the diabetes nurse has by far the major role in teaching patients how to inject. Nearly 40% of Turkish injectors get their sites checked at least annually, and a larger proportion than ROW had received recent (within the last 12 months) instruction on how to inject properly. *Conclusion*: Turkish patients and professionals have clearly made progress in injection technique, but there are still considerable challenges ahead which the new Turkish guidelines will help address.

Keywords: Infusions; Injections; Insulin; Lipodystrophy; Lipohypertrophy; Needles; Needlestick; Subcutaneous

Abbreviations

BMI	Body mass index
HbA1c	Glycated hemoglobin
HCP	Health care professional
ID	Intradermal
IM	Intramuscular
ITQ	Injection Technique Questionnaire
IU	International unit (of insulin)
LH	Lipohypertrophy
LH+	Patients with lipohypertrophy
LH−	Patients without lipohypertrophy
PD	Pharmacodynamics
PK	Pharmacokinetics
T1DM	Type 1 diabetes
T2DM	Type 2 diabetes
TDD	Total daily dose (of insulin)

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INTRODUCTION

In a previous paper we introduced the Turkish Injection Technique Questionnaire (ITQ) survey patient population and injecting practice [1]. Based on the results, Turkish best practice recommendations were drafted and endorsed by Turkish health care professionals (HCP). We propose to continue this exposé, using the same approach, for injecting complications.

METHODS

Our previous paper [1] described the methods, materials, centers, and patients who participated in the study.

Ethical Considerations

No participant-identifying information was made available to the sponsor and participants were informed that their care would not be affected in any way by their participation. They were not put at risk in any way by the study and were not paid to participate. Ethics committee approval was therefore not generally required but was obtained whenever specifically requested by a center and/or by local regulations. All 56 participating centers from 29 cities in Turkey (as in the rest of world, ROW) did so willingly and without financial incentive.

RESULTS

Lipohypertrophy

Patients were asked: Do you have any swelling or lumps under the skin at your usual injection sites that have been there for some time (weeks, months, or years)? Table 1 gives the results for both the patients' answers and the nurses' examination of all patient injection sites. Turkish results are given beside ROW. The latter constitute the values from the 41 other ITQ participating countries combined (excluding Turkey). Percentages of lipohypertrophy (LH) in

Table 1 Lipohypertrophy in Turkey vs ROW

	% Turkey N = 1364	% ROW N = 7657
Presence of lypohypertrophy as per patient report	31.2	29.0
Presence of lypohypertrophy as per nurse examination	27.4	31.5

Rest of world (ROW) constitutes the values from the 41 other ITQ participating countries combined (excluding Turkey)

Turkey were lower than in ROW (27.4% vs 31.5%, respectively).

Nurses examined each of the patient's injection sites both visually and by palpation and reported any LH (Table 2). When nurses found LH they were asked to measure the lesions along their longest dimension in millimeters. Table 3 shows that LH size in Turkish patients was on average slightly lower in the abdomen and thigh and almost the same in the arm. Whenever nurses found LH they asked the patient if they were still injecting into it and 58.8% of Turkish patients said yes. They were then asked how often they did so (Table 4). Patients who injected into LH were also asked why they did so (Table 5). More than half of

Table 2 Nurse-confirmed lipohypertrophy in Turkish and ROW patients

Site	Exam type	% Turkey N = 1259	% ROW N = 6306
Abdomen	Visual	12.9	18.2
	Palpation	14.2	22.6
Thigh	Visual	6.9	10.6
	Palpation	8.1	12.1
Buttocks	Visual	0.8	2.3
	Palpation	1.4	3.2
Arm	Visual	11.8	10.9
	Palpation	14.4	13.0

Table 3 Size of nurse-measured lipohypertrophy (LH) in Turkish (N = 384) and ROW (N = 1816) patients

Size[a]	Turkey (mean mm)	ROW (mean mm)	N Turkey	N ROW
Abdominal LH	36.5	45.5	154	1166
Thigh LH	32.3	43.9	83	404
Arm LH	35.5	35.9	147	246

[a] Size was measured as the longest dimension (usually the diameter) of the largest LH lesion present in the stated anatomic site of injection

Table 4 Frequency of injection into LH in Turkish and ROW patients

Frequency	% Turkey N = 276	% ROW N = 1688
Every injection	14.5	17.1
Frequently (daily)	49.3	37.9
Occasionally (weekly)	31.5	30.2
Seldom (monthly)	4.7	14.9

Table 5 Reasons patients report injecting into LH in Turkish and ROW patients

Reason	% Turkey N = 345	% ROW N = 1602
It's convenient	18.0	11.6
It's less painful	23.8	17.4
Just a habit	31.9	31.5
Don't know	26.4	28.3

Turkish patients answered "Don't know" to that question.

The worldwide ITQ data [2, 3] showed a strong association between the presence of LH and the total daily dose (TDD) of insulin. Over 10 international units (IU) of insulin on average was consumed in persons with lipohypertrophy

(LH+) vs persons without lipohypertrophy (LH−). In type 2 diabetes (T2DM) patients, this average TDD difference is 13.5 IU. In type 1 diabetes (T1DM) patients, the average TDD difference is 5.4 IU. The presence of LH is associated with higher glycated hemoglobin (HbA1c) values, an average difference of 0.55. In Turkey the LH+ population had an average TDD of 59.2 IU while the LH− group averaged 52.2 IU, a 7.0 IU spread ($p < 0.01$). In Turkish T1DM patients the difference in TDD between LH+ and LH− patients was only 0.8 IU (higher in LH+) but this did not achieve statistical significance ($p = 0.766$). However in T2DM the difference was striking; TDD was 13.2 IU higher in LH+ patients than in LH− ($p < 0.001$). There was also a highly significant difference in HbA1c between LH+ and LH− subjects, 9.61 vs 8.85, respectively ($p < 0.001$).

LH is associated with not rotating injection sites properly, injecting into small areas rather than broadly spreading out injections, using insulin for many years, and reusing needles. These associations are not necessarily causative of LH, but they emerge in so many studies that their role in LH formation is now widely accepted.

Our definitions of "hypoglycemia", "frequent unexplained hypoglycemia", and "glycemic variability" have been reported in previous studies [3, 4]. In the ITQ nurses reviewed the blood glucose meter results and medical records of each subject to determine who qualified for the three aforementioned complications. About a quarter of Turkish injectors had frequent unexplained hypoglycemia and about 40% had glucose variability (Table 6). In Turkish patients with these complications, LH was more common. Table 7 gives results for lipoatrophy.

Rotation of Injection Sites

Patients who give their injections a minimum of 1 cm from previous ones are said to rotate correctly. Such patients, according to worldwide ITQ results, have less glycemic variability, fewer hypo- and hyperglycemic episodes, and less LH [3]. They also have lower HbA1c values and use

Table 6 Frequency of unexplained hypoglycemia and glycemic variability in Turkish and ROW patients

	% Turkey	% ROW	N Turkey	N ROW
Frequent unexplained hypoglycemia[a]				
Yes	25.2	18.3	341	1239
No	74.8	81.7	1011	5547
Glycemic variability[b]				
Yes	38.0	34.8	513	2359
No	62.0	65.2	836	4415

[a] Hypoglycemia is defined as the occurrence of at least one symptom of low sugar (e.g., palpitations, tiredness, sweating, strong hunger, dizziness, tremor) and a confirmed blood glucose meter reading ≤ 60 mg/dL (3.3 mM/L). Frequent unexplained hypoglycemia is defined as hypoglycemia occurring one or more times weekly in the absence of a definable precipitating event such as a change in medication, diet, or activity
[b] Glycemic variability is the presence of blood glucose oscillations from less than 60 mg/dL (3.3 mM/L) to more than 250 mg/dL (13.9 mM/L) at least three times a week in an unpredictable and unexplained fashion and evidence of such a pattern for at least the previous 6 months

Table 7 Nurse-reported lipoatrophy and redness in Turkish and ROW patients

Site	Finding	% Turkey N = 1259	% ROW N = 7565
Abdomen	Lipoatrophy	0.6	0.6
	Redness	4.8	3.3
Thigh	Lipoatrophy	0.4	0.5
	Redness	5.0	2.8
Buttocks	Lipoatrophy	0.0	0.2
	Redness	0.2	0.4
Arm	Lipoatrophy	0.5	0.4
	Redness	7.6	3.6

less insulin (lower TDD) than patients who do not rotate correctly, again related to the presence of LH. We found that 74.4% of Turkish injectors rotated their sites correctly (Table 8).

Table 8 Frequency of correct rotation: Turkey vs ROW

	Turkey N = 1263	ROW N = 6730
Practice correct rotation[a]	74.4	69.9

[a] Correct rotation is defined as always injecting at least 1 cm from previous injection(s)

Bleeding, Bruising, Pain, and Leakage

Bruising or bleeding at injection sites is commonly reported, a finding that is worrying to patients but is seldom of clinical importance. In our survey 52.0% of Turkish injectors reported these findings; however, only 1.9% said it occurred "always", 22.7% reported it happened "often" (several times a week), but the majority, 53.2%, said it occurred only "sometimes" (several times a month). Nearly a quarter (22.2%) said that they saw it "almost never" (several times a year).

Approximately half of Turkish patients have pain on injection, but as with bruising, this occurred rarely. The same held for insulin leaking out of the skin at injection sites. One-third reported leakage, but, of those who did, nearly three quarters said it was rare.

Table 9 shows who gave patients their injection training. This is usually done by diabetes nurses in Turkey. This may be because

Table 9 Professional who gave patient injection training

Injection instructor	% Turkey N = 1359	% ROW N = 8081
General nurse	16.1	24.0
Diabetes nurse	70.1	42.8
Diabetes educator	6.0	13.3
Doctor (general practitioner)	0.9	5.8
Doctor (diabetes specialist)	4.2	10.9
Pharmacist	1.8	2.1
Representative of the pen/needle manufacturer	1.0	1.1

Table 10 Frequency with which injection sites are checked

Frequency	% Turkey N = 1204	% ROW N = 11,301
Routinely every visit	27.3	28.4
Once a year	11.2	12.8
Only if I complain of a problem at a site	25.5	19.6
I can't remember my sites ever being checked	36.0	39.2

Table 11 Last time patient given instructions or advice on injections

Frequency	% Turkey N = 1326	% ROW N = 8262
Within the past 6 months	49.4	35.4
Within the past 6–12 months	27.4	16.0
Sometime in the last 1–5 years	13.6	22.8
Sometime in the last 5–10 years	5.1	14.8
Never	4.5	10.9

general nurses are less involved in diabetes management in Turkey than in ROW.

Table 10 shows how frequently injection sites are checked in Turkey by HCP and the results are very similar to ROW. Nevertheless the goal of checking injection sites at least once a year is not being met for the majority of patients. Patients were asked when they last received instruction or advice on injections. Table 11 shows that Turkey is performing considerably better than ROW in giving advice within the last year.

Turkish patients were asked to report which injection topics they could not remember ever being trained on. Table 12 shows that for most topics, a similar percentage of Turkish patients could not remember being trained as in ROW.

Table 13 shows the identity of the HCP who filled out the ITQ. Turkish diabetes nurses had

Table 12 Topics patients cannot remember ever being trained on

Topic	% Turkey $N = 1265$	% ROW $N = 8790$
Injection sites (e.g., thigh, arm, buttock, abdomen)	12.8	11.6
Skin thickness and appropriate depth of injection	21.7	27.2
Length of needle	24.4	25.6
How to do a skin lift or "pinch up" the skin	20.7	18.2
How long to hold a skin lift or "pinch up"	23.9	25.7
Angle of needle entry	11.2	16.1
How long to keep the needle in the skin after injection	13.1	16.4
Rotating within an injection site	22.3	18.4
Prevention of air bubbles (syringe) or proper priming of pen needle	23.1	19.7
Mixing insulin in a syringe (for syringe users)	25.2	30.3
Re-suspension of cloudy insulin	24.0	25.0
Single use of pen needle/syringe	13.1	19.0
Safe disposal of sharps (pen needles, syringes)	37.5	28.2

Table 13 Professional who filled out the ITQ

Professional	% Turkey $N = 150$	% ROW $N = 1113$
General nurse	9.3	18.1
Diabetes nurse	88.7	51.7
Diabetes educator	2.0	25.6
Doctor (general practitioner)	0.0	1.2
Doctor (specialist)	0.0	3.4

the highest percentage, higher than in ROW. Most Turkish HCP (89.9% or 133 of 148) knew about the new injection recommendations [5]

and almost all had changed their practice as a consequence.

DISCUSSION

Injecting insulin is not without its risks [6]. These include intramuscular (IM) or intradermal (ID) injections, which often distort the pharmacokinetics (PK) and pharmacodynamics (PD) of insulin and may lead to adverse effects on glucose control; injection pain, bruising, bleeding; leakage of insulin from injection sites or the device itself; and LH. The last of these is probably the most common serious complication of incorrect injection technique, even though others often get more attention than LH [7].

LH has been the subject of considerable recent research. These lesions had largely been ignored or unknown prior to recent studies. It takes considerable skill and training before HCP can reliably diagnose LH. For example HCP should use specific palpation techniques and should learn the value of performing a skin lift or pinch for diagnosis of LH. They should understand how to compare inelastic skin to soft, elastic and easily liftable skin [8]. They should also be trained in the use of gels to achieve better lubrication and enhanced sensitivity of the fingers for detecting LH.

The better the HCP is trained at using these techniques the higher the prevalence of LH detected. The fact that LH is frequent (present in up to 2/3 s of injectors in one recent study [9]), that patients and HCP are in many cases unaware of its existence, and that patients often continue to inject into it—sometimes consciously, most often unwittingly—have come as an unwelcome surprise to the diabetes community.

In an earlier study in Turkey, Vardar and Kizilci [10] found LH in 48.8% of 215 insulin-injecting patients. By logistic regression analysis, they were able to identify three independent risk factors for LH: long-term insulin use ($p = 0.001$); failure to carefully rotate injection sites ($p = 0.004$); and the reuse of insulin needles ($p = 0.004$). Two other studies [9, 11] support these as the main risk factors for LH.

Our survey found that nearly one-third of Turkish insulin users described lesions consistent with LH at their injection sites and that an almost equal percentage were found to have LH by the examining nurse (using visual inspection and palpation). These values are consistent with those found in ROW but are lower than those in many studies in which nurses had been carefully trained to look for LH [9, 12–15]. The ITQ was performed in Turkish centers with dedicated diabetes nurses. However in Turkey there are only about 500 such nurses for the 7 million diabetic patients. Hence not all insulin injectors have the opportunity to receive training from them. This means that the true prevalence of LH could be considerably higher than what we found. In fact the Turkish values for LH found in the 2009 ITQ [16] are even lower than those found in 2015 (Table 14), possibly because nurses in earlier years were even less trained to look for LH than they are now.

Hence we may be fairly sure that a third of current Turkish insulin-using patients have LH at one or another of their injection sites (Tables 1, 2) and over half of these continue to inject into it at least daily (Table 4). Reasons for doing this are similar in Turkey as in ROW: convenience, habit, and pain-avoidance (Table 5). Turkish nurses who examined injection sites found more LH by palpation than they did visually (Table 2), a pattern that holds also in ROW. This points to the importance of examining sites carefully using both the eyes and hands. Nurses should lubricate their hands with gel before the exam and use an undulating, circular motion, similar to the one used to examine the breast. Table 3 shows that LH lesions in Turkey average about 35 mm (3.5 cm), a dimension easy enough to detect, once one begins to look for them.

Almost all studies of patients injecting into LH show insulin absorption to be unpredictable and/or delayed, often leading to poor glucose control [17–21]. In the best one of these studies, glucose clamps were used in patients with LH [22] to assess PK and PD when insulin was injected into LH compared to normal tissue. Results showed that PK is substantially blunted in LH injections and PD is much more variable compared to injections into normal

Table 14 Comparison of previous Turkish ones (2009) with latest Turkish ITQ results (2015)

Parameter	2009	2015
Number of participants	597	1376
Number of participating centers	18	56
Age of participants (mean in years)	48.1	45.0
Duration of therapy (mean in years)	6.9	6.9
BMI of participants (kg/m^2, mean)	28.3	28.5
HbA1c (%, mean)	8.2	9.1
Participants using insulin pen	98.3%	98.1%
Participants using 8 mm needle	83.5%	34.7%
Participants using needle > 8 mm	5.3%	0.9%
Participants using needle < 8 mm	11.2%	64.4%
Participants injecting into abdomen[a]	88.9%	86.5%
Participants injecting into thigh[a]	75.5%	80.1%
Participants injecting into buttocks[a]	10.8%	20.5%
Participants injecting into arm[a]	66.7%	84.2%
Participants injecting using pinch up	87.7%	52.3%
Rotation of injection sites	89.7%	90.2%
Prevalence of occasional bleeding or bruising	81.4%	60.2%
Prevalence of patient-reported LH	31.1%	31.2%
Prevalence of nurse-discovered LH	21.8%	27.4%
Participants who reuse pen needles	44.2%	24.2%
Injections sites checked on every office visit	18.8%	27.3%
Needles disposed into rubbish directly	80.8%	70.0%
Disposal into rubbish without recapping	8.6%	5.8%

[a] Percentages add to over 100 because patients use multiple sites

tissue. A mixed meal study in the same patient population confirmed the slower PK and decreased PD of insulin when LH injections are compared with those into normal tissue, with much greater glucose excursions post-meal in the former case.

More than a quarter of Turkish patients have frequent unexplained hypoglycemia and nearly 2 out of 5 have glycemic variability (Table 6), both of which have been linked to the presence of LH and the habit of injecting into it [3]. Therefore, Turkish patients with LH should be instructed to stop injecting into LH and move to healthy sites without LH. Once patients begin injecting in these new sites they will need to reduce their insulin dose, likely by up to 20%. HCP should instruct patients to reduce doses immediately, starting with the first injection into non-LH tissue. Insulin injected into the new sites has a normal PK and PD and if patients continue with their usual doses this will almost always result in hypoglycemia.

Injections should be rotated so that new injections are always given in a different site (at least 1 cm) from previous ones. Patients should also refrain from reusing needles, since used needles may cause more tissue trauma and increase the risk for LH. Turkish patients without LH should be instructed to carefully follow the rotation and reuse advice above in order to avoid LH in the future. Several studies have shown that the surest way to keep tissue healthy is to consistently rotate injection sites as described above [23–25]. We found that Turkish patients who did rotate sites were largely following this 1-cm rule already (Table 8).

Education seems to work when it comes to LH. In a multicenter interventional study in the UK [26] an educational approach focused on the above recommendations (rotating sites, using 4-mm needles, and no reuse) resulted in significantly lower clinically detectable LH levels after 6 months. LH either disappeared completely or decreased by approximately half its original size. The average HbA1c decreased by more than 4 mmol/L (approximately 0.5%) and there were significantly lower levels of unexplained hypoglycemia and glucose variability. The mean TDD decreased by 5.6 IU by study end.

In a prospective, controlled, multicenter study in France, in which all patients had LH [27], an intervention similar to that in the UK study led to a significant decrease of TDD (5 IU vs baseline, $p = 0.035$), decreases in HbA1c (mean fall of 0.5%), and significant improvement in injection technique habits after 6 months. In a recently published study in Russia [28] patients who received interventions similar to the above had HbA1c falls of approximately 1% in a similar time period.

In the Turkish study, as with ROW, we did not find that key injection parameters (e.g., correct rotation, avoidance of LH, appropriate needle length, correct use of skin folds, single use of needles, safe sharps disposal) were better or worse as a function of duration of insulin therapy. Patients who have been injecting insulin for years often have engrained errors in technique and need the same training and education as newer-to-insulin patients.

In Turkey the diabetes nurse has by far the largest role in teaching patients how to inject. Nearly 40% of Turkish injectors get their sites checked at least annually, and a larger proportion than ROW had received recent (within the last 12 months) instruction on how to inject properly. Unfortunately the optimal timing for inspection of injection sites for LH and other complications has not yet been established by clinical studies. Similarly, the optimal timing for giving injection training is still unstudied. Nevertheless the new insulin delivery recommendations elaborate strategies for both based on experience and consensus opinion [5]. More than 60% of Turkish patients reported that they can not remember their sites ever being checked or only get them checked if they complained. This clearly indicates that we still need to focus on appropriate injection techniques in the country.

Table 14 compares the ITQ results from 2009 with those of 2015 for certain key parameters. The two study populations were not the same and the questionnaires were slightly different, but there was sufficient overlap to justify our comparison. It is clear that there has been a dramatic "shift to short" in terms of needle length. With this shift, fewer patients are pinching up the skin; in fact with the shortest (4 mm) needle this is no longer needed, except in very select populations. Bleeding and bruising are also down. Several other encouraging signs are seen: pen needle reuse is less frequent, more patients are having their injection sites checked at each office visit, and disposal of used sharps is somewhat better. However HbA1c is

higher in our most recent study, for unknown reasons. For most other parameters, including body mass index (BMI), injection sites used, and LH, the values are essentially unchanged.

Limitations

Like all broad surveys that aim to be representative, the ITQ cast a wide net for both patients and HCP. Our patient population included a spectrum of patients from those who had had best-in-class training for injection technique to those who reported getting no injection training at all. Most, however, fell somewhere in between. Consequently the patient injection practices we report on here span from optimal to the clearly substandard and even dangerous. Similarly, the injection technique expertise of HCP varied widely as well. It was, for example, impossible to train all HCP to the same level of expertise in the diagnosis of LH. Recent studies have shown that flat or non-palpable LH requires a much higher level of expertise to diagnose than visible or easily palpable LH. Flat or non-visible LH can be identified by pinching the skin where the presence of LH is suspected and comparing the thickness of the skin fold with nearby normal areas [29, 30]. It is probable that we included HCP who might be proficient at diagnosing easily detected lesions, but not the more subtle ones. This might account for the relatively low percentages of LH detected compared to findings in other published studies where HCP were carefully trained in LH detection. However, we believe this broad approach, though limiting our study in some respects, best reflects the real world of injection practice in Turkey and ROW.

CONCLUSIONS

In summary, Turkish patients and professionals have clearly made progress in injection technique, but there are still considerable challenges ahead which the new injection techniques and treatment guideline for health care professionals will help address. This study provides a basis for improving the injection site examination in general clinical practice and also creating protocols for detecting and preventing LH in Turkey. The authors plan to conduct another ITQ approximately 1 year after these guidelines are published in order to assess their impact on Turkish injection practice.

Dagdelen, Oguzhan Deyneli, Nermin Olgun, Zeynep Osar Siva, Mehmet Sargin, Sükrü Hatun, Mustafa Kulaksizoglu and Ahmet Kaya) have nothing to disclose.

Compliance with Ethics Guidelines. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. No participant identifying information was made available to the sponsor and participants were informed that their care would not be affected in any way by their participation. They were not put at risk in any way by the study and were not paid to participate. Ethics committee approval was therefore not generally required but was obtained whenever specifically requested by a center and/or by local regulations. All 56 participating centers from 29 cities in Turkey (as in rest of world, ROW) did so willingly and without financial incentive.

APPENDIX

Table 15 Health care professionals who participated in this study

City	Center	Name of diabetes nurse	Patients
Adana	Cukurova Universitesi Tip Fakultesi Balcali Hastanesi	AYFER BAHTİYAR	32
		GÜLCAN DELİDAĞ (Pediatric Diabetes Nurse)	
Afyon	Afyon Kocatepe Universitesi Hastanesi	NUR ŞERİF KARADEMİR	31
		SONGÜL UÇAR	
Amasya	Sabuncuoglu Serefeddin Egitim ve Arastirma Hastanesi	ÇAĞLA DEMİR	25
Ankara	Ankara Ataturk Egitim Ve Arastirma Hastanesi	BİRGÜL GENÇ	25
Ankara	SBU Ankara Dr. Sami Ulus Kadın Dogum Cocuk Sagligı ve Hastaliklari Egitim Ve Arastirma Hastanesi	NURDAN YILDIRIM (Pediatric Diabetes Nurse)	37
Ankara	Hacettepe Universitesi Hastanesi	AYŞE İLHAN	32
Ankara	Hacettepe Universitesi Ihsan Dogramaci Cocuk Hastanesi	SERPİL ÇAKMAK (Pediatric Diabetes Nurse)	21

Table 15 continued

City	Center	Name of diabetes nurse	Patients
Ankara	Ozel Bayindir Hastanesi	SEVİLAY SUNGUR YURDAKUL	35
		HANİFE AKMAN	
		NERİMAN TARHAN	
Ankara	Diskapi Yildirim Beyazit Egitim Ve Arastirma Hastanesi	FATMA GÖROĞLU	25
Antalya	Akdeniz Universitesi Hastanesi	ŞEFİKA DALKIRAN	25
Denizli	Denizli Devlet Hastanesi	HAFİZE KANYILMAZ	29
		GÖKÇE GÖKÇE	
Antalya	Saglik Bilimleri Universitesi Antalya Egitim ve Arastirma Hastanesi	AYFER UMAY	6
		AYSUN ÜNAL	
		SEHER DEMİR	
Balikesir	Ayvalik Devlet Hastanesi	SEVGİ DUMAN	18
Balikesir	Devlet Hastanesi	RABİA CEYLAN SALI	25
Bolu	Abant Izzet Baysal Universitesi Tip Fakultesi Hastanesi	SATI CAN	25
Bursa	SBU Bursa Yuksek Ihtisas Egitim Arastirma Hastanesi	SİBEL YAVAŞ	19
Bursa	Uludag Universitesi Saglik Uygulama Ve Arastima Hastanesi	GÜLSEV DİRİK	33
Bursa	Bursa Yenisehir Devlet Hastanesi	İLDA EROL	25
Çanakkale	Canakkale Devlet Hastanesi	HACER KARABULUT	16
Diyarbakir	Diyarbakır Cocuk Hastaliklari Hastanesi	MÜLKİYE AYDIN	25
Düzce	Ataturk Devlet Hastanesi	İLKAY BAYRAM	31
Edirne	Trakya Universitesi Saglik Araştırma ve Uygulama Merkezi	ÖZLEM COŞAR ÜNAL	31
		BURCU KESKİN (Pediatric Diabetes Nurse)	
Erzurum	Ataturk Universitesi Arastirma Hastanesi/Ataturk Universitesi Saglik Arastirma ve Uygulama Merkezi	SEVİNÇ DAKAK	7
		SERPİL ÜÇPINAR	
Eskişehir	Acibadem Eskisehir Hastanesi	AYFER AKTAŞ	23
Eskişehir	Eskisehir Osmangazi Universitesi Saglık Arastirma ve Uygulama Hastanesi	KEVSER KARAOĞLU	26
		SADİFE KARATEPE	
		SEVİYE MAHMUTOĞLU İNAN	
Giresun	GIRESUN UNIVERSITEİİ PROF. DR. A. ILHAN OZDEMİR EGITIM ARASTIRMA HASTANESI	MEDİHA DÖNMEZ KURT	5

Table 15 continued

City	Center	Name of diabetes nurse	Patients
İstanbul	Kadıkoy/Kozyatagi Acibadem Hastaneleri	GÜLİN ÇEVİK	11
		ÖZNUR YÜCE	
		YASEMİN KANEK	
İstanbul	Istanbul Saglık Bilimleri Universitesi Kanuni Sultan Suleyman Egitim ve Arastirma Hastanesi	GÜLDEN ANATACI	6
İstanbul	Marmara Universitesi Istanbul Pendik Egitim ve Araştırma Hastanesi	SERPİL ESMEN	25
İstanbul	Bagcilar Egitim Ve Arastirma Hastanesi	SULTAN YURTSEVER	30
İstanbul	Istanbul Universitesi Cerrahpaşa Tip Fakultesi Hastanesi	ŞENAY ZUHUR	25
		TÜLAY TOKGÖZ ŞİMŞEK	
İstanbul	Haseki Egitim Ve Arastirma Hastanesi	EMINE YILMAZLAR	30
İstanbul	Istanbul Universitesi İstanbul Tip Fakultesi Hastanesi	SELDA ÇELİK	24
		SALİHA YILMAZ (Pediatric Diabetes Nurse)	
İstanbul	Istanbul Kartal Dr. Lutfi Kirdar Egitim ve Arastirma Hastanesi	ŞENGÜL IŞIK	25
İstanbul	Pendik Kaynarca Semt Poliklinigi Diyabet Merkezi	GÜL İPEK YANILMAZ	32
		GÖNÜL ERKUT	
İstanbul	Medeniyet Universitesi Goztepe Egitim Ve Arastirma Hastanesi	DERYA KARAMAN	26
		NURDAN YÖRÜK	
İstanbul	Istanbul Sisli Hamidiye Etfal Egitim ve Arastirma Hastanesi	GÜLBAHAR POLAT	25
İstanbul	Umraniye Egitim Ve Arastirma Hastanesi	ZEKİYE ÇELİKÖZ	28
İzmir	Dokuz Eylul Universitesi Arastirma Uygulama Hastanesi	HATİCE TEKELİ ASLAN (Pediatric Diabetes Nurse)	26
		BELGİN BEKTAŞ	
İzmir	Ege Universitesi Tip Fakultesi Hastanesi	YILDIZ ÖZBEY	31
		NURAN HOROZOĞLU	
		GÜNAY DEMİR (Pediatric Diabetes Nurse)	
Kayseri	Erciyes Universitesi Tip Fakultesi Hastanesi	SACİDE KILIÇ	25
		NURTEN VARİYENLİ (Pediatric Diabetes Nurse)	
Kayseri	Saglik Bilimleri Universitesi Kayseri Egitim Ve Arastirma Hastanesi	HAYRİYE TOPRAK BEYAZ	36
Kocaeli	Kocaeli Devlet Hastanesi	ALİME KARATAŞ	25

Table 15 continued

City	Center	Name of diabetes nurse	Patients
Kocaeli	Kocaeli Universitesi Arastirma ve Uygulama Hastanesi	YASEMİN ERKEK	25
		YELİZ ERDEM	
		SEVGİ AKSOY AKBEL (Pediatric Diabetes Nurse)	
		EBRU ERCANLI (Pediatric Diabetes Nurse)	
Konya	Konya Egitim Ve Arastirma Hastanesi	FATOŞ ERDAĞI	25
Konya	Necmettin Erbakan Universite Hastanesi Meram Tip Fakultesi	FATMA ÖZDAMAR	29
Malatya	Malatya Egitim Arastirma Hastanesi	MELEK YILDIRIM	7
Mersin	Mersin Toros Devlet Hastanesi	RABİYA DÖLEK	25
Mersin	Mersin Universitesi Saglık Arastirma ve Uygulama Hastanesi	EYLEM TÜRK	31
Ordu	Ordu Devlet Hastanesi	CANDEĞER UZUNLAR	30
Samsun	Ondokuz Mayis Universitesi Tip Fakultesi Hastanesi	GÖNÜL GÜVELİ (Pediatric Diabetes Nurse)	25
		GÜLAY BAYRAK	
Sivas	Cumhuriyet Universitesi Arastirma ve Uygulama Hastanesi	ZEHRA ÇELİK	36
Sivas	Sivas Numune Hastanesi	RABİA AKÇA	26
Tekirdağ	Tekirdag Devlet Hastanesi	SERAP MAVİLİ	30
Trabzon	Karadeniz Teknik Universitesi Saglik Uygulama Arastirma Merkezi Farabi Hastanesi	NİLGÜN ÇATALAHMETOĞLU	25
Zonguldak	Bulent Ecevit Universitesi Saglik Uygulama ve Arastirma Hastanesi	SAFİYE KÖKDEN ÇATALÇAM	32

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