

TDM검사 신빙도조사 결과보고 (2002)

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대한임상정도관리협회 TDM분과위원회

Annual Report on External Quality Assessment in Therapeutic Drug Monitoring in Korea (2002)

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Three trials of external quality assessment for Therapeutic Drug Monitoring (TDM) subcommittee of Korean Association of Quality Assurance for Clinical Pathology (KAQACP) were performed in 2002. Participating laboratories were 79 similar to the previous year. Response rates were 96.3% for 1st, 2nd, and third trials. In the first trial, 20 test items among 27 ones were responded from as least from one laboratory as follows: acetaminophen, amikacin, amitriptyline, carbamazepine, cyclosporine, digoxin, free phenytoin, gentamicin, lithium, methotrexate, phenobarbital, phenytoin, primidone, quinidine, salicylate, tacrolimus (FK-506), theophylline, tobramycin, valproic acid and vancomycin. In the second and third trial, the test items were same with those of 1st trial except the exclusion of quinidine. We included tacrolimus with a whole blood control material in addition to cyclosporine from the first trial. The most common test items were valproic acid, digoxin, phenytoin, carbamazepine, theophylline, and phenobarbital which were performed in more than 77% of participating laboratories. The most widely used TDM analyzer was Abbott TDx/TDxFLx (56%), but its proportion were decreased slightly comparing with the previous years. In conclusion, we added tacrolimus from the year of TDM proficiency testing in 2002 and found grossly similar pattern comparing with those of previous years.

Key Words : Quality assurance, External quality assessment, Therapeutic drug monitoring

서 론

대한임상검사전도관리협회 TDM분과위원회에서 1995년도부터 혈중 약물농도검사에 대한 신빙도 조사를 시작하여 첫 보고[1] 이후 매년 1회씩 보고를 하여 왔고[2-6], 이번에 분과위원회 위원이 2001년도가 제7년째가 되었다. 이해에는 전혈 정도관리 물질을 사용하여 Cyclosporine 및 Tacrolimus 종목을 추가하는 등 다음과 같은 몇 가지 변

화가 있었다.

재료 및 방법

1. 관리물질

제1회차에는 TDM검사 인혈청(人血清) 정도관리물질인 Lyphocheck[®] TDM Control (Bio-Rad Laboratories, Hercules, CA, USA) Level 2는 총 82개 참여 기관을 대상으로, 전혈(全血) 정도관리물질인 Lyphocheck[®] whole blood control (Bio-Rad Laboratories, Hercules, CA, USA) Level 2는 Cyclosporine 또는 Tacrolimus 검사를 시행하는 총 35개 기관을 대상으로 2002년 7월 5일에 발송하였다. 제2회차에는 TDM검사 정도관리물질 Lyphocheck[®] TDM Control (Bio-Rad Labo-

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ratories, Hercules, CA, USA) Level 1 및 Level 3의 두 종류를 총 82개 참여 기관을 대상으로, Lyphocheck[®] whole blood control (Bio-Rad Laboratories, Hercules, CA, USA) Level 1 및 3의 두 종류를 역시 Cyclosporine 또는 Tacrolimus 검사를 시행하는 총 35개 기관을 대상으로 2002년 11월 11일에 발송하였다.

2. 조사종목 및 방법

2001년도에 TDM분과에서 실시한 약물검사 신빙도 조사종목은 1차 및 2차 모두 전년도와 마찬가지로 acetaminophen, amikacin, amitriptyline, carbamazepine, chloramphenicol, cyclosporine, digoxin, disopyramide, ethosuximide, free phenytoin, gentamicin, lidocaine, lithium, methotrexate, N-acetyl-procainamide, phenobarbital, phenytoin, primidone, procainamide, propranolol, quinidine, salicylate, tacrolimus (FK-506), theophylline, tobramycin, valproic acid, vancomycin 등 27항목에 대한 신빙도 조사를 실시하였으나, 제1회차에서는 회신한 기관이 없는 chloramphenicol, disopyramide, ethosuximide, lidocaine, N-acetyl-procainamide, procainamide, propranolol 등을 제외한 총 20종목을 대상으로 평가하였고, 제2회차에서는 quinidine을 또한 제외하여 총 19종목을 대상으로 평가하였다. 정도관리 물질로 검사하기 위해서 Lyphocheck[®] TDM control은 사용 시 검사 당일에 탈이온수를 정확히 5.0 mL를 넣어 용해시키며 실온에 15분간 세워 둔 후 잘 섞어 사용하도록 하였다. 한편, Lyphocheck[®] Whole blood control은 검사 당일에 탈이온수를 정확히 2.0 mL를 넣어 용해시키며 실온에 20분간 세워 둔 후 잘 섞어 사용하도록 하였다.

3. 결과분석 및 통계

결과분석 및 통계처리는 Microsoft Excel 97, Microsoft Access 2000 및 Analyse-it Software (Version 1.63, Leeds, England, United Kingdom)을 사용하였다. 단위 및 유효숫자를 임의대로 한 기관에 대해서는 본 TDM분과에서 제시한 것으로 일괄 처리 하였다. 또한 검사 장비코드를 기록하지 않은 기관은 전년도와 동일 코드로 처리하였으며 통계 분석은 각 검사 종목별로 장비의 차이를 고려하지 않은 전체 통계와 각 장비별 (peer group)로 평균치, 표준편차, standard deviation index (SDI) 값을 내되, SDI값이 +3 또는 -3을 벗어 나는 기관의 결과치는 제외하고 다시 평균, 표준편차, 및 SDI값을 계산하도록 프로그램을 하여 보고하였다. 단, 참여 기관이 1 기관인 경우에는 통계에서 제외되었다. 또한 각 군별로 변이계수 (coefficient of variation), 최저값, 및 최대값을 산출하였다. 본 분과위원회의 TDM 검사에서 수탁 기관으로서의 불인정 기준은 다음과 같이 처리하였다. 해당 연도에 정도관리사업의 참여가 전혀 없는 경우는 자동적으로 수탁 불인

정 기관이 되지만, 그 외에 다음 두 경우에도 수탁 불인정으로 처리하였다. (1) 매 회차 참여마다 참여 종목 수에 관계없이 2개 종목 이상에서 장비별(peer group) SDI값이 +3 이상 또는 -3 미만의 성적을 보인 경우, 또는 (2) 매 회차 참여마다 참여 종목 수에 관계없이 4개 종목 이상에서 장비별(peer group) SDI값이 +2 이상 또는 -2 미만의 성적을 보인 기관으로 하였다.

결 과

1. 참여기관 및 검사실시종목

약물검사 정도관리물질은 모두 82기관 중에서 1차에는 79기관이 회신을 하여 회신율이 96.3%였고, 2차에도 역시 79기관이 회신을 하여 회신율이 96.3%로 연평균 96.3%로서 전년도 평균 91.3%보다 증가하였다(Table 1). 회신 기관수는 작년까지는 Fig. 1.과 같이 작년까지는 점차 증가하였으나, 2002년에는 정체 상태였다. 또한 각 기관 당 검사 종목 수는 평균 6.3종목으로 예년에 비해 오히려 약간 감소하였다(Table 2).

약물검사의 종목 당 실시기관수를 살펴보면 Table 3과 같았다. 참가 기관의 증가로 carbamazepine, digoxin, phenobarbital, phenytoin, phenobarbital, valproic acid 등의 주요 종목들이 전체적으로 약간씩 증가하였고 cyclosporine 도 증가하였다(Table 3). 처음 실시하는 Tacrolimus (FK-506) 은 14기관에서 응답하여 8.1%의 응답율을 보였고, 이는 Cyclosporine 실시 기관의 절반 수준이었다. 드물게 실시되는 종목인 ethosuximide와 procainamide는 최근 2년 연속 실시 기관이 없었으며, 대부분의 종목들은 전년도와 유사하였다.

2. 검사장비별 이용 현황

2001년도에도 검사방법 및 장비코드는 전년도와 동일한 방법으로 조사하였다. 장비코드를 잘못 기록한 기관이 상당수 있었다. 가장 많은 예는 신설된 Abbott IMx 기종을 Abbott TDx(FLx) 기종으로 적어 보낸 예였다. 검사종목별 장비의 이용 현황을 보면 가장 많이 이용되는 장비는 Abbott사의 TDx(FLx)가 56%의 가장 많은 비율로 사용되고 있었으나, 전년도 비율 58.5%에 비해서는 감소하였다. 다음은 Abbott사의 AxSym으로 17.1%의 종목을 검사하였다고 이는 전년 대비 약간 증가한 수준이었다(Table 4.) 다음은 Roche사의 Cobas Integra의 사용율이 16.6%로서 전년의 12.4%에 비해 꾸준히 증가하였다. 그 외에 Dade Behring사의 OPUS, Abbott사의 IMx, Dade Behring사의 ACA, Bayer사의 ACS180, HPLC, RIA 순이었다(Table 4). Lithium검사의 경우에는 검사 방법이나 장비의 사용에 있어서 전체 lithium검사 기관의 89%인 23 기관에서 ISE (Ion selective electrode)법이 이용되고 있어 작년 80%에 비해 계속 그 비율이 증가하였다. Atomic absorption spectrophotometry

법 및 Flame emission photometry를 이용한 기관이 각각 2기관 및 1기관이었다 (Table 5).

3. 결과 분석

2002년도 TDM분과에서 실시한 약물검사 신빙도조사의 항목별 검사실간의 변이계수(CV)값을 보면 Table 6, Table 7, 및 Table 8과 같이 각 농도별로 나누어 볼 때 많은 항목에서 향상된 것을 볼 수 있었다.

각 검사 항목별 신빙도 조사 결과를 장비별 평균, 표준편차, 변이계수, 참가기관 검사결과의 최저치, 최대치를 Table 9-28에 정리하였다. 또한 2종 이상의 검사방법으로 시행되었으며, 2기관 이상에서 시행한 항목들은 방법별 차이를 보기 위해 Fig. 2에서 Fig. 14까지 표시하였다. 이해부터는 제2회차 및 3회차 정도관리 물질을 함께 송부하여 저농도(DC-02-01)와 고농도(DC-02-03)의 정도관리 물질을 함께 보내어 혹 있을 수 있는 계통오차를 볼 수 있도록 하였다. 2002년도에 정도관리 사업에 성적으로 말미암아 수탁 불인정이 된 기관은 없었다.

고 찰

대한임상정도관리협회 TDM분과위원회의 '02년도 신빙도 조사사업에서는 참가 기관과 회신율이 모두 전년도와 유사하였다(Table 1). 조사종목은 1차에는 전년도와 동일하게 27종목이 가능하였으나, 1차에서는 20종, 2차에서는 19종만이 회신이 되었다. Ethosuximide, procainamide 등은 2년째 회신 기관이 없었다. TDM신빙도 조사 초기에는 회신이 있었으나, 최근 회신이 되지 않기 시작한 lidocaine, N-acetylprocainamide, propranolol과 현재 1-3개 기관만 회신이 되고 있는 amitriptyline, quinidine 등의 정도관리는 임상에서의 약물 사용양도 줄고, 약물 농도 검사 의뢰도 없는 것에 기인한 것으로 사료되었다. Cyclosporine의 경우에 일부 기종으로서의 혈청으로서의 정도관리가 불가능한 바 [7] 이번 사업부터는 전혈을 정도관리물질 별도로 추가하여 Cyclosporine 뿐만 아니라 Tacrolimus (FK-506) 항목이 추가되었다. Tacrolimus의 경우 비교적 높은 8.1%의 회신율을 보였고, Cyclosporine의 회신율도 33.5%로 증가되어 면역억제제의 치료 약물모니터링의 관심이 증가되는 것을 관찰하였다. 사용 기종 중 사용 비율이 가장 많은 TDx/TDxFLx가 약간 줄고 Cobas Integra의 비율이 약간 증가하는 양상은 예년과 유사하였다. 각 기관별 평가를 위해서 검사 기종의 차이를 고려하지 않은 항목별 SDI값과 검사 기종별 SDI값을 별도로 보고하였다[7]. 정도관리 결과 송부시 소수점을 Salicylate의 단위를 mg/dL로 회신하기로 요청했으나, 이를 mg/L로 회신한 기관이 있어서 주의가 요망되었다. 앞으로는 drug free serum 및 약물을 구해 정도관리 물질을 자가 제조하여 사용하는 것을 검토할 필요가 있다고 본다[8].

결론적으로 2001년도 TDM신빙도 조사는 회신율이 약간 증가하고, 전혈 정도관리 물질을 사용하여 Tacrolimus의 항목이 추가된 외에는 전년도와 유사한 경향이었다.

요 약

1. 약물검사를 실시하는 기관은 전년도와 유사한 79기관이었다.
2. 약물검사 신빙도 조사에 대한 참여기관의 회신율은 1차, 2차, 3차 모두 96.3%로써 평균 회신율은 96.3%로 전년도에 비해 증가하였다.
3. 가장 많은 기관에서 검사를 하고있는 약물검사로는 valproic acid, digoxin, phenytoin, carbamazepin, theophylline, phenobarbital 등 6종으로서 전체참여기관 86 기관 중 60 기관 이상에서 실시하고 있었다.
4. 연도별 검사 기관간 변이 계수를 정도관리 물질 농도별로 예년과 비교할 때 많은 항목에서 향상된 것을 관찰할 수 있었다.
5. 전혈 정도관리물질을 사용하여 4년만에 재개된 Tacrolimus (FK-506)은 8.1%의 기관에서 참여하였다.
6. 약물검사 전체 참여기관 당 평균 검사종목 수와 항목별 검사기관수에 있어서는 전년도와 큰 차이가 없었으나 ethosuximide, procainamide 등은 2년째 1 기관도 회신하지 않았고, quinidine, amitriptyline 등의 약물의 참여가 여전히 미미하였다.
7. 검사장비의 이용율은 Abbott사의 TDx/TDxFLx가 전년 대비 감소하기는 하였으나, 56% 이상의 사용율을 보였으며, 반면에 Roche 사의 Cobas Integra의 사용율은 16.6%로 증가하였다.

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Table 1. Number of institution who responded in TDM proficiency testing in Korean Association of Quality Assurance and Clinical Laboratories (KAQACL) in the year of 2002 and the previous year

Trial	No. of institution participated	No. of institution responded (response rate%)	Average
First trial of 2001	86	77 (89.5%)	91.3%
Second trial of 2001	86	80 (93.0%)	
First trial of 2002	82	79 (96.3%)	96.3%
Second and third trials of 2002	82	79 (96.3%)	

Table 2. Test items of TDM proficiency testing of KAQACL in recent five years

No. of Test Items	1998		1999		2000		2001		2002		
	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	3rd trial
1	4	2	3	6	3	4	3	4	3	3	3
2	5	6	6	4	6	4	5	5	5	8	8
3	1	2	4	3	2	3	3	5	2	1	1
4	6	4	3	2	5	3	3	3	6	4	4
5	6	7	5	6	5	6	6	6	6	6	6
6	13	10	12	33	15	32	18	17	13	15	15
7	18	18	18	4	13	8	11	15	16	14	14
8	7	7	7	9	9	3	10	10	9	9	9
9	3	5	7	2	6	3	4	3	5	6	6
10	2	0	2	1	4	1	3	1	1	1	1
11	2	3	3	1	2	1	3	4	5	3	3
12	1	1	0	0	0	2	3	2	0	0	0
13	1	1	1	0	2	1	3	2	3	5	5
14	1	0	1	2	2	0	0	1	4	2	2
15	0	0	1	0	1	0	1	0	0	1	1
16	0	1	0	0	0	0	1	2	0	0	0
17	1	0	0	0	1	0	0	0	1	1	1
18	1	1	1	0	0	0	0	0	0	0	0
Total number of institutions	63	60	65	63	67	63	77	80	79	79	79
Average test items	6.60	6.58	6.68	5.84	6.57	5.91	6.94	6.69	6.40	6.32	6.32
No. of test items evaluated	26	26	26	17	26	17	26	26	27	27	27

Table 3. Distribution of test items in TDM proficiency testing in KAQACL in recent five years

Name of Drug	1998		1999		2000		2001		2002			Average# No. of Institution	Average# % of response
	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	3rd trial		
Acetaminophen	5	4	4	3	3	4	4	4	4	5	5	4.1	5.4%
Amikacin	9	10	10	13	13	12	15	15	15	15	15	14.3	18.5%
Amitriptyline	2	2	1	*	2	*	3	2	3	3	3	2.7	3.5%
Carbamazepine	60	56	61	60	62	62	66	68	66	66	66	65.1	84.4%
Cyclosporine	16	17	21	*	20	*	20	25	30	30	30	25.8	33.5%
Digoxin	64	62	65	63	64	62	67	68	68	67	67	66.1	85.7%
Ethosuximide	3	2	3	3	2	1	0	0	0	0	0	0.4	0.6%
Free Phenytoin	1	3	3	*	3	*	3	4	5	5	5	4.2	5.4%
Gentamicin	10	8	7	6	6	5	9	8	8	8	8	7.4	9.6%
Lithium	25	25	28	*	29	*	30	30	27	26	26	28.0	36.3%
Methotriexate	15	15	16	*	14	*	16	17	16	17	17	16.2	21.0%
Phenobarbital	56	54	55	55	57	57	61	61	60	60	60	59.4	77.0%
Phenytoin	61	58	60	61	63	62	65	68	66	66	66	65.1	84.4%
Primidone	7	6	7	7	9	8	7	5	5	5	5	6.3	8.1%
Procainamide	1	0	1	1	1	1	0	0	0	0	0	0.3	0.4%
Quinidine	2	2	2	2	1	1	1	0	1	0	0	0.6	0.7%
Salicylate	7	4	7	7	5	4	6	5	6	6	6	5.4	7.0%
Tacrolimus (FK-506)	10	9	0	0	0	0	0	0	16	14	14	6.3	8.1%
Theophylline	62	61	62	61	61	59	62	64	66	66	66	63.4	82.2%
Tobramycin	4	4	3	4	3	3	7	8	8	8	8	6.4	8.3%
Valproic Acid	55	52	63	62	64	62	67	68	70	70	70	67.3	87.2%
Vancomycin	9	10	12	12	17	13	17	15	17	13	13	15.0	19.4%
Total number of institution responded	72	68	74	73	75	71	77	80	79	79	79	77.1	100.0%

*, test items was not evaluated in the year

#, average is calculated with numbers of recent 3years(2001, 2002, 2003)

Table 4. Usage of the instrument for TDM KQACL proficiency testing in 2002

Name of Instruments	2001		2002		Ranking
	No. of Usage	%	No. of Usage	%	
Abbott TDx/TDxFLx	586	58.5%	867	56.0%	1
Abbott AxSym	157	15.7%	265	17.1%	2
Roche Cobas Integra	124	12.4%	257	16.6%	3
Dade Behring Opus	45	4.5%	48	3.1%	4
Abbott IMx	0	0.0%	44	2.8%	5
Dade Behring ACA	27	2.7%	27	1.7%	6
Bayer ACS180	19	1.9%	22	1.4%	7
HPLC	3	0.3%	6	0.4%	8
RIA	3	0.3%	6	0.4%	9
Beckman Access	2	0.2%	3	0.2%	10
Johnson & Johnson	0	0.0%	3	0.2%	11
Other method	24	2.4%	0	0.0%	
Microgenics CEDIA	10	1.0%	0	0.0%	
DPC Immulite	1	0.1%	0	0.0%	
Sum	1001	100.0%	1548	100.0%	

Table 5. Distribution of institution in the year of 2002 for lithium in KQACL proficiency testing.

Principle of determination	1st trial	2nd trial	3rd trial	Average
ISE*	24	23	23	88.6%
AAS*	2	2	2	7.6%
FES*	1	1	1	3.8%
Sum	27	26	26	100.0%

*ISE, ion selective electrode method; AAS, atomic absorption spectrophotometric method; FES, flame emission spectrophotometry

Table 6. Mean between-laboratory CV of each item using low-level control materials in recent 5 years

Item \ Trials	1998-1st	1999-2nd	2000-1st	2001-1st	2002-2nd	Average
Acetaminophen	6.0	6.2	15.6	11.2	21.4	12.1
Amikacin	9.8	7.2	16.0	10.4	8.0	10.3
Amitriptyline	-	-	-	4.9	23.7	14.3
Carbamazepine	17.8	14.5	8.2	9.3	19.6	13.9
Cyclosporine	23.3	*	10.4	10.5	11.9	14.0
Digoxin	18.8	39.0	11.9	14.4	11.9	19.2
Ethosuximide	19.0	9.7	7.8	-	-	12.2
Free Phenytoin	*	*	15.8	16.1	16.7	16.2
Gentamicin	6.9	12.1	2.4	10.3	6.9	7.7
Lithium	25.8	*	16.4	26.6	15.3	21.0
Methotriexate	7.1	*	7.7	10.5	10.5	9.0
Phenobarbital	17.5	13.1	7.7	7.1	7.9	10.7
Phenytoin	14.8	10.5	9.9	11.2	6.5	10.6
Primidone	13.0	11.2	7.8	8.5	7.8	9.7
Quinidine	-	-	-	-	-	-
Salicylate	-	25.7	30.4	15.5	14.1	21.4
Tacrolimus(FK506)	15.4	*	*	*	14.1	14.8
Theophylline	22.4	10.7	7.1	9.5	6.3	11.2
Tobramycin	6.7	13.5	1.6	8.1	8.7	7.7
Valproic Acid	9.1	21.2	6.7	7.0	6.0	10.0
Vancomycin	21.3	14.2	13.4	11.8	6.7	13.5
Total mean CV	15.0	14.9	10.9	11.3	11.1	12.5

All numbers are between-laboratory coefficient of variation (CV, %) regardless of methods. Several results of some institution was deleted for the calculation of CV since they had random error. Amitriptyline was according to high performance of liquid chromatography.

-, CV could not be calculated since number of institution responded was one or zero

*, not evaluated

Table 7. Mean between-laboratory CV of each item using medium-level control materials in recent 5 years

Item / Trials	1999-1st	2002-1st	Average
Acetaminophen	23.2	14.6	18.9
Amikacin	5.2	5.2	5.2
Amitriptyline	-	26.9	26.9
Carbamazepine	8.6	7.3	7.9
Cyclosporine	8.6	16.1	12.3
Digoxin	16.7	8.1	12.4
Ethosuximide	11.3	-	11.3
Free Phenytoin	-	22.6	22.6
Gentamicin	7.2	13.5	10.4
Lithium	24.4	13.2	18.8
Methotriexate	19.7	17.7	18.7
Phenobarbital	7.0	5.2	6.1
Phenytoin	4.7	6.3	5.5
Primidone	9.7	6.4	8.0
Quinidine	5.6	-	5.6
Salicylate	40.1	3.4	21.8
Tacrolimus(FK506)	*	5.4	5.4
Theophylline	9.7	5.2	7.5
Tobramycin	16.1	5.2	10.7
Valproic Acid	5.8	6.8	6.3
Vancomycin	12.7	9.5	11.1
Total mean CV	13.1	9.5	11.3

All numbers are between-laboratory coefficient of variation (CV, %) regardless of methods. Several results of some institution was deleted for the calculation of CV since they had random error. Amitriptyline was according to high performance of liquid chromatography.

-, CV could not be calculated since number of institution responded was one or zero

*, not evaluated

Table 8. Mean between-laboratory CV of each item using high-level control materials in recent 5 years

Item / Trials	1998-2nd	2000-2nd	2001-2nd	2002-3rd	Average
Acetaminophen	7.8	4.5	16.9	9.0	9.6
Amikacin	16.6	11.8	5.7	6.1	10.0
Amitriptyline	-	*	-	10.9	10.9
Carbamazepine	12.8	1.8	10.3	9.3	8.5
Cyclosporine	6.5	*	20.3	9.0	11.9
Digoxin	12.9	16.7	11.6	8.9	12.5
Ethosuximide	7.4	*	-	-	7.4
Free Phenytoin	*	*	19.9	18.2	19.1
Gentamicin	6.4	9.3	9.4	6.1	7.8
Lithium	25.7	*	17.9	17.6	20.4
Methotriexate	16.2	*	8.1	8.1	10.8
Phenobarbital	14.9	16.4	11.5	7.6	12.6
Phenytoin	14.6	16.1	7.6	5.3	10.9
Primidone	4.5	5.9	3.8	4.1	4.6
Quinidine	2.1	*	-	-	2.1
Salicylate	8.5	11.6	3.9	5.8	7.5
Tacrolimus(FK506)	10.6	*	*	14.6	12.6
Theophylline	12.5	9.2	6.1	7.1	8.7
Tobramycin	10.3	4.1	9.1	6.0	7.4
Valproic Acid	9.8	7.4	7.2	7.0	7.8
Vancomycin	18.9	4.3	15.1	11.5	12.4
Total mean CV	11.5	9.2	10.8	9.0	10.2

All numbers are between-laboratory coefficient of variation (CV, %) regardless of methods. Several results of some institution was deleted for the calculation of CV since they had random error. Amitriptyline was according to high performance of liquid chromatography.

-, CV could not be calculated since number of institution responded was one or zero

*, not evaluated

Table 9. Acetaminophen proficiency testing results of KQAACL in the year of 2002 (unit, $\mu\text{g/mL}$)

Method	DC-02-01				DC-02-02				DC-02-03			low value			high value			
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	4	35.5	5.20	14.6	5	9.76	2.09	21.5	5	106.7	9.65	9.0	30.0	7.8	94.6	42.0	12.0	120.0
Abbott TDx	2	39.5	3.54	9.0	2	12.0	0.0	0.0	2	116.0	11.3	9.8	37.0	12.0	112.0	42.0	12.0	120.0
Roche Integra	2	31.5	2.12	6.7	3	8.27	0.64	7.8	3	100.5	5.2	5.1	30.0	7.8	94.6	33.0	9.0	104.0

Table 10. Amikacin proficiency testing results of KAQACL in the year of 2002 (unit, µg/mL)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	15	14.4	0.75	5.21	15	4.11	0.33	8.11	15	27.63	1.68	6.09	13.2	3.6	17.7	16.1	4.9	30.3
Abbott(TDx)	11	14.26	0.64	4.51	11	4.04	0.21	5.23	11	27.25	3.5	12.85	13.2	3.6	17.7	15.4	4.3	30.3
Cobas Integra	4	14.67	1.03	7.05	4	4.33	0.54	12.43	4	26.2	0.99	3.79	13.7	3.6	25	16.1	4.9	27.4

Table 11. Amitriptyline proficiency testing results of KAQACL in the year of 2002 (unit, ng/mL)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
Abbott TDx	1	545.0	-	-	1	289.5	-	-	1	918.6	-	-	545.0	289.5	918.6	545.0	289.5	918.6
HPLC	2	256.9	60.95	23.73	2	63.0	16.97	26.94	2	182.0	19.8	10.9	213.8	51.0	168.0	300.0	75.0	196.0

* Abbott TDx 로 검사하는 방법은 Total TCA를 측정하고 HPLC법과 함께 비교하기 곤란하므로 All method에 의한 평균치 산정은 하지 않았음.

-, CV could not be calculated since number of institution responded was one or zero

Table 12. Carbamazepine proficiency twsting results of KAQACL in the year of 2002 (unit µg/mL)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	66	9.63	0.7	7.31	66	3.27	0.64	19.63	66	16.62	1.54	9.26	7.7	2.0	6.9	19.5	15.0	19.7
Abbott TDx	35	9.82	0.72	7.3	36	3.37	0.84	24.81	36	16.45	1.43	8.68	7.8	2.0	6.9	19.5	15.0	18.5
Abbott AxSym	13	9.46	0.64	6.8	13	3.17	0.15	4.88	13	16.65	1.1	6.59	7.8	2.9	14.6	10.2	3.4	18.9
Cobas Integra	11	9.27	0.23	2.51	10	3.1	0.07	2.15	10	17.29	0.92	5.34	8.9	3.0	15.9	9.6	3.2	18.4
BDI Opus	3	10.1	0.51	5.1	3	3.6	0.26	7.35	3	19.47	0.21	1.07	9.5	3.4	19.3	10.5	3.9	19.7
Dade aca	2	9.3	0.28	3.04	2	3.05	0.07	2.32	2	14.7	0.28	1.92	9.1	3.0	14.5	9.5	3.1	14.9
ACS:180	1	7.7	-	-	1	2.3	-	-	1	12.1	-	-	7.7	2.3	12.1	7.7	2.3	12.1
Other method	1	10.7	-	-	1	3.4	-	-	1	15.1	-	-	10.7	3.4	15.1	10.7	3.4	15.1

-, CV could not be calculated since number of institution responded was one or zero

Table 13. Cyclosporine proficiency testing results of KAQACL in the year of 2002 (unit, ng/mL)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	30	208.4	33.51	16.08	30	77.03	9.13	11.85	30	527.61	47.3	8.96	130.0	56.24	130.0	308.0	220.0	647.0
Abbott TDx	23	204.8	18.03	8.81	23	79.58	8.44	10.6	23	528.44	41.31	7.82	130.0	56.24	130.0	262.0	220.0	643.0
Cobas Integra	3	199.3	18.58	9.32	3	68.0	2.65	3.89	3	482.7	34.07	7.06	184.0	66.0	450.0	220.0	71.0	518.0
RIA	2	206.0	19.8	9.61	2	70.5	3.54	5.01	2	612.0	49.5	8.09	192.0	68.0	577.0	220.0	73.0	647.0
Abbott AxSym	1	298.0	-	-	1	61.0	-	-	1	515.0	-	-	298.0	61.0	515.0	298.0	61.0	515.0
Other method	1	308.0	-	-	1	195.0	-	-	1	488.0	-	-	308.0	195.0	488.0	308.0	195.0	488.0

-, CV could not be calculated since number of institution responded was one or zero

Table 14. Digoxin proficiency testing results of KAQACL in the year of 2002 (unit, ng/mL)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	68	1.85	0.15	8.33	67	0.75	0.08	10.4	67	3.15	0.28	8.87	1.5	0.42	2.55	2.2	0.9	3.82
Abbott TDx	32	1.78	0.1	5.71	32	0.72	0.07	10.41	32	3.02	0.17	5.51	1.5	0.42	2.58	2.0	0.89	3.24
Abbott AxSym	15	1.91	0.15	7.8	15	0.8	0.06	7.09	15	3.08	0.23	7.33	1.6	0.71	2.55	2.2	0.9	3.35
Cobas Integra	11	2.01	0.11	5.66	10	0.8	0.05	6.23	10	3.63	0.15	4.21	1.7	0.72	3.43	2.1	0.88	3.82
BDI Opus	3	1.53	0.06	3.77	3	0.66	0.02	3.17	3	3.15	0.17	5.42	1.5	0.64	3.01	1.6	0.68	3.34
ACS:180	2	1.95	0.07	3.63	2	0.71	0.02	3.01	2	3.04	0.11	3.72	1.9	0.69	2.96	2.0	0.72	3.12
Beckman Access	1	1.8	-	-	1	0.62	-	-	1	3.05	-	-	1.8	0.62	3.05	1.8	0.62	3.05
Dade aca	1	1.8	-	-	1	0.78	-	-	1	3.17	-	-	1.8	0.78	3.17	1.8	0.78	3.17
Other method	3	1.93	0.06	2.99	3	0.82	0.07	8.54	3	3.47	0.15	4.44	1.9	0.75	3.3	2.0	0.89	3.6

-, CV could not be calculated since number of institution responded was one or zero

Table 15. Free phenytoin proficiency testing results of KAQACL in the year of 2002 (unit, µg/mL)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	5	2.12	0.48	22.65	5	0.96	0.16	17.1	5	3.24	0.59	18.29	1.46	0.73	2.54	2.54	1.14	3.84
Abbott TDx	5	2.12	0.48	22.65	5	0.96	0.16	17.1	5	3.24	0.59	18.29	1.46	0.73	2.54	2.54	1.14	3.84

Table 16. Gentamicin proficiency testing results of KQAACL in the year of 2002 (unit, $\mu\text{g/mL}$)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	8	5.61	0.76	13.62	8	3.2	0.22	6.89	8	7.67	0.47	6.14	4.3	3.0	7.0	6.8	3.7	8.4
Abbott TDx	5	5.54	0.97	17.53	5	3.26	0.26	8.0	5	7.86	0.35	4.46	4.3	3.1	7.5	6.8	3.7	8.4
Cobas Integra	2	5.55	0.21	3.82	2	3.1	0.14	4.56	2	7.05	0.07	1	5.4	3.0	7.0	5.7	3.2	7.1
Abbott AxSym	1	6.1	-	-	1	3.1	-	-	1	8.0	-	-	6.1	3.1	8.0	6.1	3.1	8.0

-, CV could not be calculated since number of institution responded was one or zero

Table 17. Lithium proficiency testing results of KQAACL in the year of 2002 (unit, mEq/L)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	27	1.51	0.2	13.38	26	0.59	0.09	14.52	26	2.39	0.42	17.49	1.17	0.45	1.75	1.92	0.73	3.3
NOVA CRT	8	1.59	0.15	9.69	7	0.61	0.05	8.93	7	2.74	0.41	14.89	1.45	0.56	2.31	1.92	0.7	3.3
Vitros	7	1.65	0.1	6.23	6	0.68	0.04	6.11	6	2.39	0.14	5.67	1.48	0.6	2.2	1.8	0.71	2.6
Cobas Integra	2	1.32	0.06	4.8	2	0.51	0.01	1.37	2	2.16	0.13	6.21	1.28	0.51	2.07	1.37	0.52	2.26
Beckman Synchron	2	1.65	0.18	11.14	2	0.65	0.11	17.41	2	2.77	0.65	23.49	1.52	0.57	2.31	1.78	0.73	3.23
AAS	2	1.22	0.08	6.35	2	0.46	0.01	3.07	2	1.81	0.09	5.06	1.17	0.45	1.75	1.28	0.47	1.88
Flame Emission	1	1.24	-	-	1	0.47	-	-	1	1.82	-	-	1.24	0.47	1.82	1.24	0.47	1.82
NOVA Others	1	1.62	-	-	2	0.56	0.02	3.82	2	2.48	0.22	8.86	1.62	0.54	2.32	1.62	0.57	2.63
IL	1	1.21	-	-	1	0.51	-	-	1	1.84	-	-	1.21	0.51	1.84	1.21	0.51	1.84
AVL Scientific	1	1.32	-	-	-	-	-	-	-	-	-	-	1.32	-	-	1.32	-	-
Chiron 654-ISE	1	1.3	-	-	1	0.6	-	-	1	2.1	-	-	1.3	0.6	2.1	1.3	0.6	2.1
Other method	1	1.27	-	-	1	0.53	-	-	1	2.11	-	-	1.27	0.53	2.11	1.27	0.53	2.11
Vitros DT60II	-	-	-	-	1	0.5	-	-	1	2.2	-	-	-	0.5	2.2	-	0.5	2.2

AAS, atomic absorption spectrophotometry

-, CV could not be calculated since number of institution responded was one or zero

Table 18. Methotrexate proficiency testing results of KQAACL in the year of 2002 (unit, $\mu\text{mol/L}$)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	16	1.13	0.2	17.97	17	0.38	0.04	9.8	17	8.26	0.67	8.06	0.56	0.31	4.95	1.47	0.46	9.81
Abbott TDx	15	1.1	0.19	16.94	16	0.38	0.04	10.03	16	8.07	1.06	13.15	0.56	0.31	4.95	1.42	0.46	9.81
Kodak	1	1.47	-	-	1	0.36	-	-	1	7.91	-	-	1.47	0.36	7.91	1.47	0.36	7.91

-, CV could not be calculated since number of institution responded was one or zero

Table 19. Phenobarbital proficiency testing results of KQAACL in the year of 2002 (unit, $\mu\text{g/mL}$)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	60	24.9	1.3	5.24	60	10.24	0.81	7.9	60	49.43	3.74	7.57	20.5	0.6	42.6	36.8	12.4	79.7
Abbott TDx	35	24.91	1.12	4.48	34	10.3	0.93	9.07	34	48.64	2.51	5.16	20.5	0.6	42.6	28.4	12.4	60.1
Abbott AxSym	11	25.72	1.43	5.56	12	10.26	0.43	4.14	12	50.34	5.24	10.4	23.5	9.6	44.9	28.1	11.0	62.9
Cobas Integra	9	24.47	0.68	2.77	9	10.17	0.44	4.29	9	49.46	1.4	2.83	23.5	9.5	47.2	25.6	10.8	51.5
BDI Opus	2	36.7	0.14	0.39	2	10.6	1.84	17.34	2	70.05	13.65	19.48	36.6	9.3	60.4	36.8	11.9	79.7
Dade aca	1	23.2	-	-	1	10.1	-	-	1	45.8	-	-	23.2	10.1	45.8	23.2	10.1	45.8
ACS:180	1	25.0	-	-	1	8.6	-	-	1	45.5	-	-	25.0	8.6	45.5	25.0	8.6	45.5
Other method	1	25.4	-	-	1	10.0	-	-	1	50.2	-	-	25.4	10.0	50.2	25.4	10.0	50.2

-, CV could not be calculated since number of institution responded was one or zero

Table 20. Phenytoin proficiency testing results of KQACL in the year of 2002 (unit, µg/mL)

Method	DC-02-01			DC-02-02			DC-02-03			low value			high value					
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	66	15.01	0.95	6.36	66	6.94	0.45	6.48	66	22.6	1.2	5.3	12.3	5.8	19.0	17.6	7.7	31.1
Abbott TDx	35	15.19	0.77	5.09	35	7.0	0.44	6.33	35	22.44	1.25	5.56	12.3	5.8	19.0	17.6	7.5	24.3
Abbott AxSym	14	15.12	0.72	4.77	15	7.16	0.32	4.49	15	23.07	0.93	4.04	14.0	6.7	21.5	16.2	7.7	24.4
Cobas Integra	11	14.14	0.88	6.23	10	6.38	0.3	4.78	10	22.23	1.14	5.12	12.7	5.9	20.4	16.1	6.8	23.4
BDI Opus	2	16.4	0.28	1.72	2	7.05	0.21	3.01	2	30.05	1.48	4.94	16.2	6.9	29.0	16.6	7.2	31.1
Dade aca	2	15.3	0.14	0.92	2	7.1	0.14	1.99	2	23.25	0.21	0.91	15.2	7.0	23.1	15.4	7.2	23.4
ACS:180	1	14.4	-	-	1	6.6	-	-	1	21.0	-	-	14.4	6.6	21.0	14.4	6.6	21.0
Other method	1	16.9	-	-	1	7.0	-	-	1	24.8	-	-	16.9	7.0	24.8	16.9	7.0	24.8

-, CV could not be calculated since number of institution responded was one or zero

Table 21. Primidone proficiency testing results of KQACL in the year of 2002 (unit, µg/mL)

Method	DC-02-01			DC-02-02			DC-02-03			low value			high value					
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	5	5.98	0.38	6.41	5	3.32	0.26	7.8	5	12.4	0.51	4.11	5.7	2.9	11.5	6.6	3.6	12.7
Abbott TDx	1	6.6	-	-	1	3.3	-	-	1	12.7	-	-	6.6	3.3	12.7	6.6	3.3	12.7
Cobas Integra	4	5.82	0.19	3.25	4	3.33	0.3	8.98	4	12.33	0.56	4.51	5.7	2.9	11.5	6.1	3.6	12.7

-, CV could not be calculated since number of institution responded was one or zero

Table 22. Quinidine proficiency testing results of KQACL in the year of 2002 (unit, µg/mL)

Method	DC-02-01			DC-02-02			DC-02-03			low value			high value					
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	1	3.0	-	-	-	-	-	-	-	-	-	-	3.0	-	-	3.0	-	-
Abbott TDx	1	3.0	-	-	-	-	-	-	-	-	-	-	3.0	-	-	3.0	-	-

-, CV could not be calculated since number of institution responded was one or zero

Table 23. Salicylate proficiency testing results of KAQACL in the year of 2002 (unit, mg/dL)

Method	DC-02-01			DC-02-02			DC-02-03			low value			high value					
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	6	14.32	0.49	3.43	6	2.98	0.42	13.97	6	41.67	2.43	5.83	13.6	2.67	37.4	14.9	3.8	44.4
Cobas Integra	4	14.35	0.34	2.38	4	3.07	0.5	16.31	4	42.05	1.04	2.48	14.0	2.67	41.4	14.8	3.8	43.6
Abbott TDx	2	14.25	0.92	6.45	2	2.8	0.14	5.05	2	40.9	4.95	12.1	13.6	2.7	37.4	14.9	2.9	44.4

Table 24. Tacrolimus (FK-506) proficiency testing results of KAQACL in the year of 2002 (unit, mg/dL)

Method	DC-02-01			DC-02-02			DC-02-03			low value			high value					
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	16	14.69	0.79	5.35	14	6.31	0.89	14.13	14	22.68	3.32	14.63	13.4	4.5	18.6	16.7	7.6	29.0
Abbott IMX	16	14.69	0.79	5.35	14	6.31	0.89	14.13	14	22.68	3.32	14.63	13.4	4.5	18.6	16.7	7.6	29.0

Table 25. Theophylline proficiency testing results of KAQACL in the year of 2002 (unit, µg/mL)

Method	DC-02-01			DC-02-02			DC-02-03			low value			high value					
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	66	14.53	0.76	5.21	66	4.63	0.29	6.35	66	27.59	1.97	7.14	12.3	3.7	23.1	16.4	6.4	34.2
Abbott TDx	34	14.55	0.38	2.61	34	4.59	0.28	6.16	34	27.01	1.51	5.59	12.4	3.7	23.1	15.3	6.4	33.8
Abbott AxSym	15	14.99	0.94	6.27	16	4.72	0.21	4.44	16	28.01	1.21	4.33	12.3	4.38	25.6	16.4	5.3	30.0
Cobas Integra	10	14.32	0.6	4.17	9	4.73	0.21	4.48	9	27.19	1.13	4.16	12.9	4.4	24.5	14.9	5.0	28.8
BDI Opus	3	14.53	0.84	5.77	3	4.07	0.06	1.42	3	33.93	0.25	0.74	14.0	4.0	33.7	15.5	4.1	34.2
Dade aca	1	15.4	-	-	1	5.2	-	-	1	29.7	-	-	15.4	5.2	29.7	15.4	5.2	29.7
ACS:180	1	13.1	-	-	1	4.2	-	-	1	26.4	-	-	13.1	4.2	26.4	13.1	4.2	26.4
Other method	2	14.25	0.35	2.48	2	4.85	0.35	7.29	2	25.85	0.21	0.82	14.0	4.6	25.7	14.5	5.1	26.0

-, CV could not be calculated since number of institution responded was one or zero

Table 26. Tobramycin proficiency testing results of KAQACL in the year of 2002 (unit, µg/mL)

Method	DC-02-01			DC-02-02			DC-02-03			low value			high value					
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	8	3.85	0.2	5.19	8	1.03	0.09	8.65	8	7.54	0.45	5.93	3.5	0.9	7.0	4.1	1.2	8.1
Abbott TDx	7	3.9	0.15	3.92	7	1.04	0.08	7.54	7	7.6	0.44	5.84	3.7	1.0	7.0	4.1	1.2	8.1
Cobas Integra	1	3.5	-	-	1	0.9	-	-	1	7.1	-	-	3.5	0.9	7.1	3.5	0.9	7.1

-, CV could not be calculated since number of institution responded was one or zero

Table 27. Valproic acid proficiency testing results of KQACL in the year of 2002 (unit, µg/mL)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	70	74.71	5.05	6.75	70	33.44	1.99	5.96	70	111.22	7.73	6.95	63.0	29.0	89.0	87.0	40.0	128.3
Abbott TDx	38	73.58	4.24	5.76	38	32.85	1.79	5.45	38	108.18	5.14	4.76	63.0	29.0	89.0	85.0	37.2	117.0
Abbott AxSym	14	78.5	5.02	6.39	15	35.16	1.51	4.29	15	119.48	5.27	4.41	66.0	33.0	110.5	87.0	38.0	128.3
Cobas Integra	11	71.73	4.03	5.61	10	32.46	1.14	3.52	10	108.86	4.12	3.79	68.0	30.1	103.1	82.0	34.5	117.0
BDI Opus	3	83.0	1.73	2.09	3	33.6	2.16	6.44	3	116.33	2.08	1.79	81.0	31.8	114.0	84.0	36.0	118.0
Dade aca	2	76.5	3.54	4.62	2	39.5	0.71	1.79	2	125.0	2.83	2.26	74.0	39.0	123.0	79.0	40.0	127.0
ACS:180	1	70.0	-	-	1	33.0	-	-	1	97.0	-	-	70.0	33.0	97.0	70.0	33.0	97.0
Other method	1	74.0	-	-	1	34.0	-	-	1	117.0	-	-	74.0	34.0	117.0	74.0	34.0	117.0

-, CV could not be calculated since number of institution responded was one or zero

Table 28. Vancomycin proficiency testing results of KQACL in the year of 2002 (unit, µg/mL)

Method	DC-02-01				DC-02-02				DC-02-03				low value			high value		
	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	No. Lab	Mean	SD	CV (%)	1st	2nd	3rd	1st	2nd	3rd
All methods	17	35.92	3.43	9.55	13	12.42	0.83	6.72	13	70.64	8.11	11.48	28.0	11.0	58.4	62.2	19.8	86.0
Abbott TDx	9	39.48	9.16	23.2	6	13.85	3.05	22.05	6	67.1	9.84	14.67	32.5	11.5	58.4	62.2	19.8	86.0
Abbott AxSym	1	35.9	-	-	2	11.8	1.13	9.59	2	69.7	1.98	2.84	35.9	11.0	68.3	35.9	12.6	71.1
Cobas Integra	6	36.28	1.91	5.26	5	12.42	0.54	4.39	5	75.26	5.41	7.18	33.2	11.8	66.4	38.9	13.2	79.9
ACS:180	1	28.0	-	-	-	-	-	-	-	-	-	-	28.0	-	-	28.0	-	-

-, CV could not be calculated since number of institution responded was one or zero.

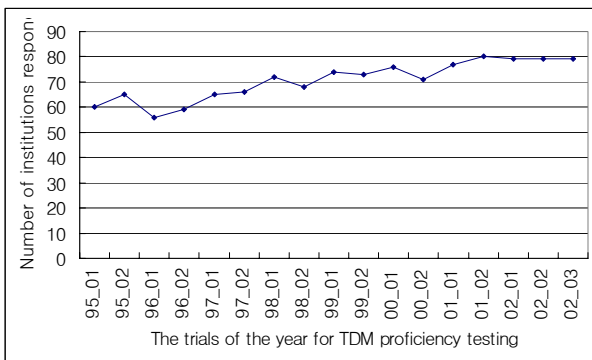


Fig. 1. Change of number of participating laboratories in TDM proficiency testing in KQACL according to the trials of the year.

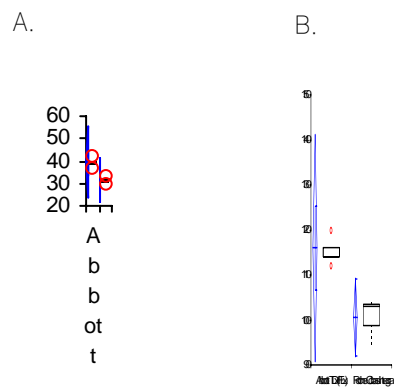


Fig. 2. Acetaminophen results according to the method in TDM proficiency testing in KQACL in the year of 2002. A. DC-02-01 (low level), first trial; B. DC-02-03 (high level), third trial. The graph of the second trial was not included due to zero SD.

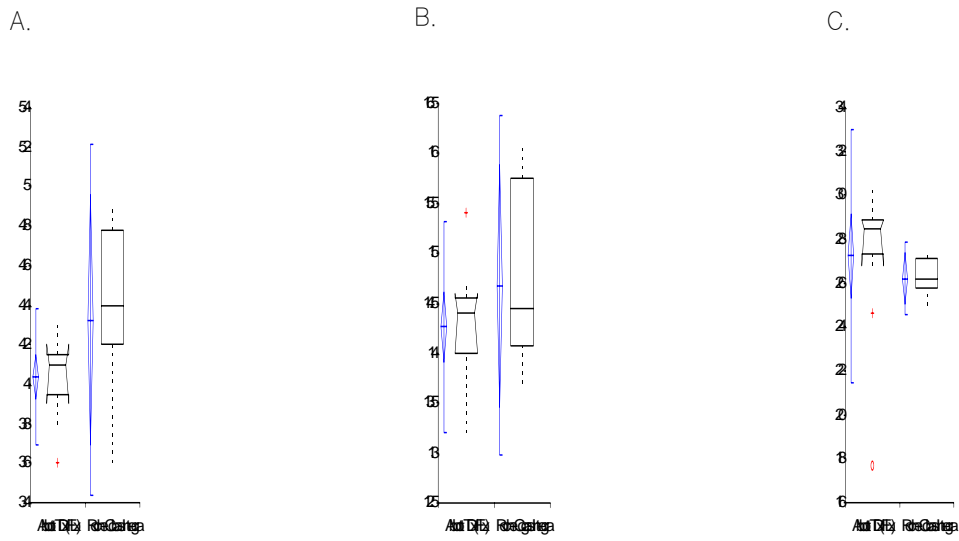


Fig. 3. Amikacin results according to the method in TDM proficiency testing in KAQACL in the year of 2002. A. DC-02-02 (low level), second trial; B. DC-02-01 (medium level), first trial; C. DC-02-03 (high level), third trial.

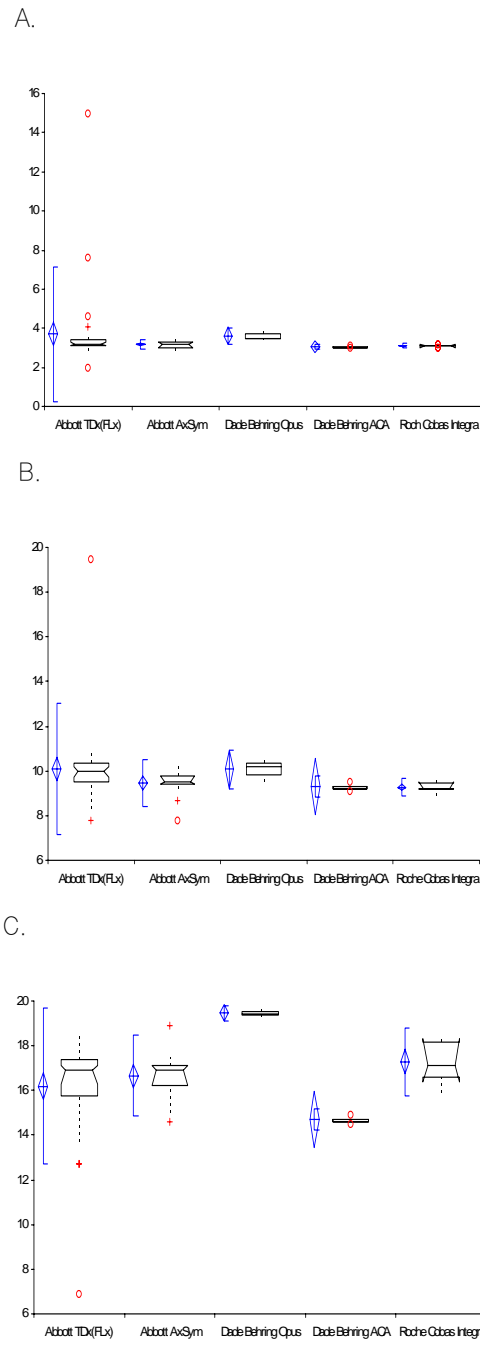


Fig. 4. Carbamazepine results according to the method in TDM proficiency testing in KQACL in the year of 2002. A, DC-02-02 (low level), second trial; B, DC-02-01 (medium level), first trial; C, DC-02-03 (high level), third trial.

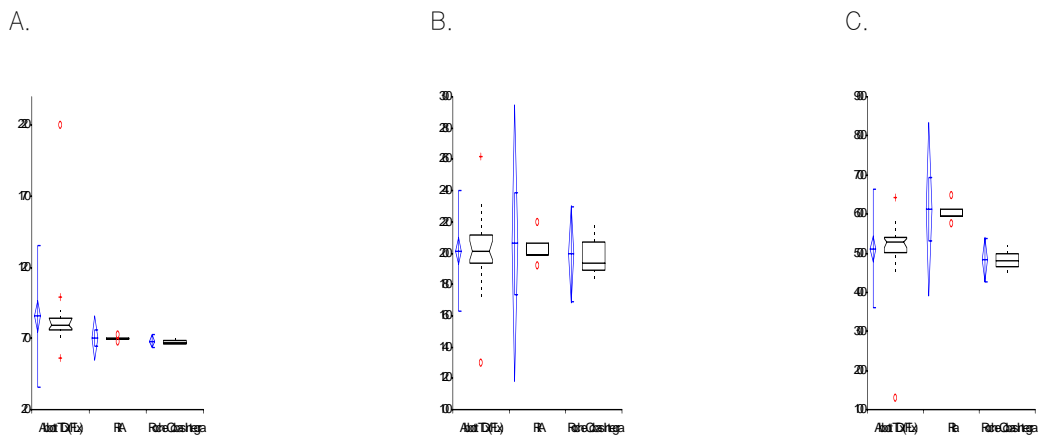


Fig. 5. Cyclosporine A results according to the method in TDM proficiency testing in KAQACL in the year of 2002. A, DC-02-02 (low level), second trial; B, DC-02-01 (medium level), first trial; C, DC-02-03 (high level), third trial.

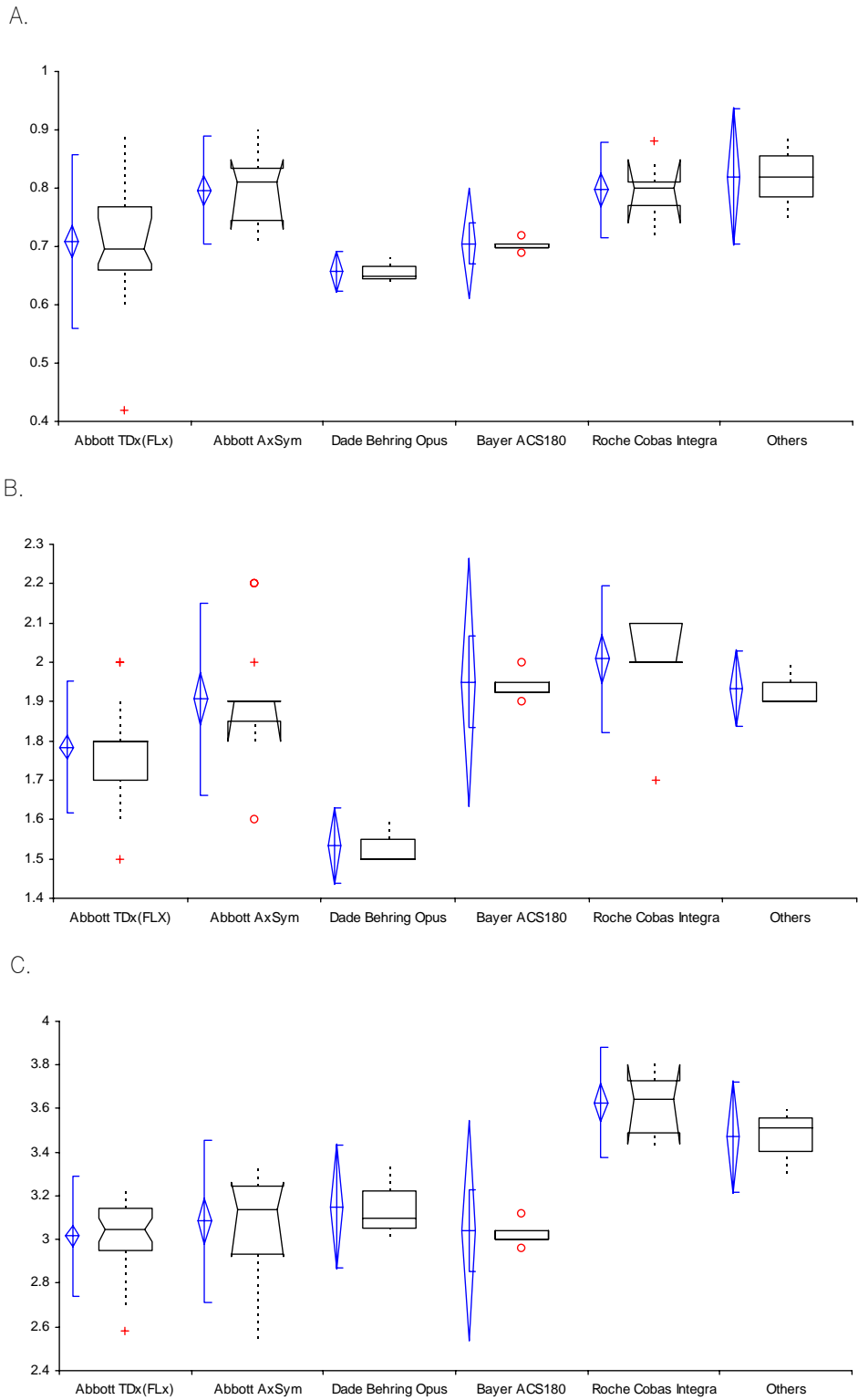


Fig. 6. Digoxin results according to the method in TDM proficiency testing in KAQACL in the year of 2002. A, DC-02-02 (low level), second trial; B, DC-02-01 (medium level), first trial; C, DC-02-03 (high level), third trial.

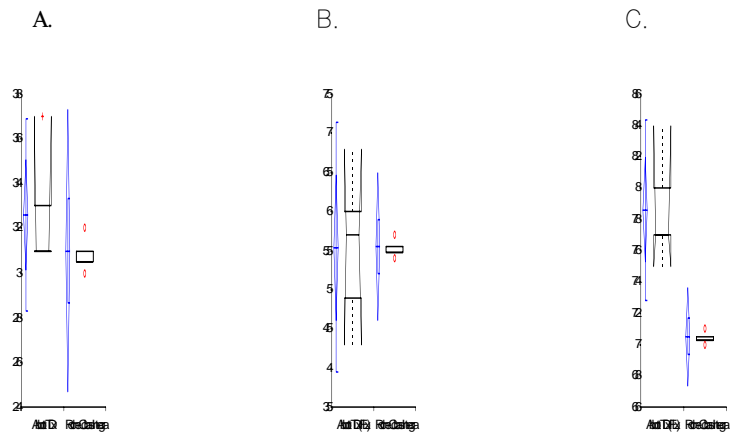


Fig. 7. Gentamicin results according to the method in TDM proficiency testing in KQACCL in the year of 2002. A. DC-02-02 (low level), second trial; B, DC-02-01 (medium level), first trial; C, DC-02-03 (high level), third trial.

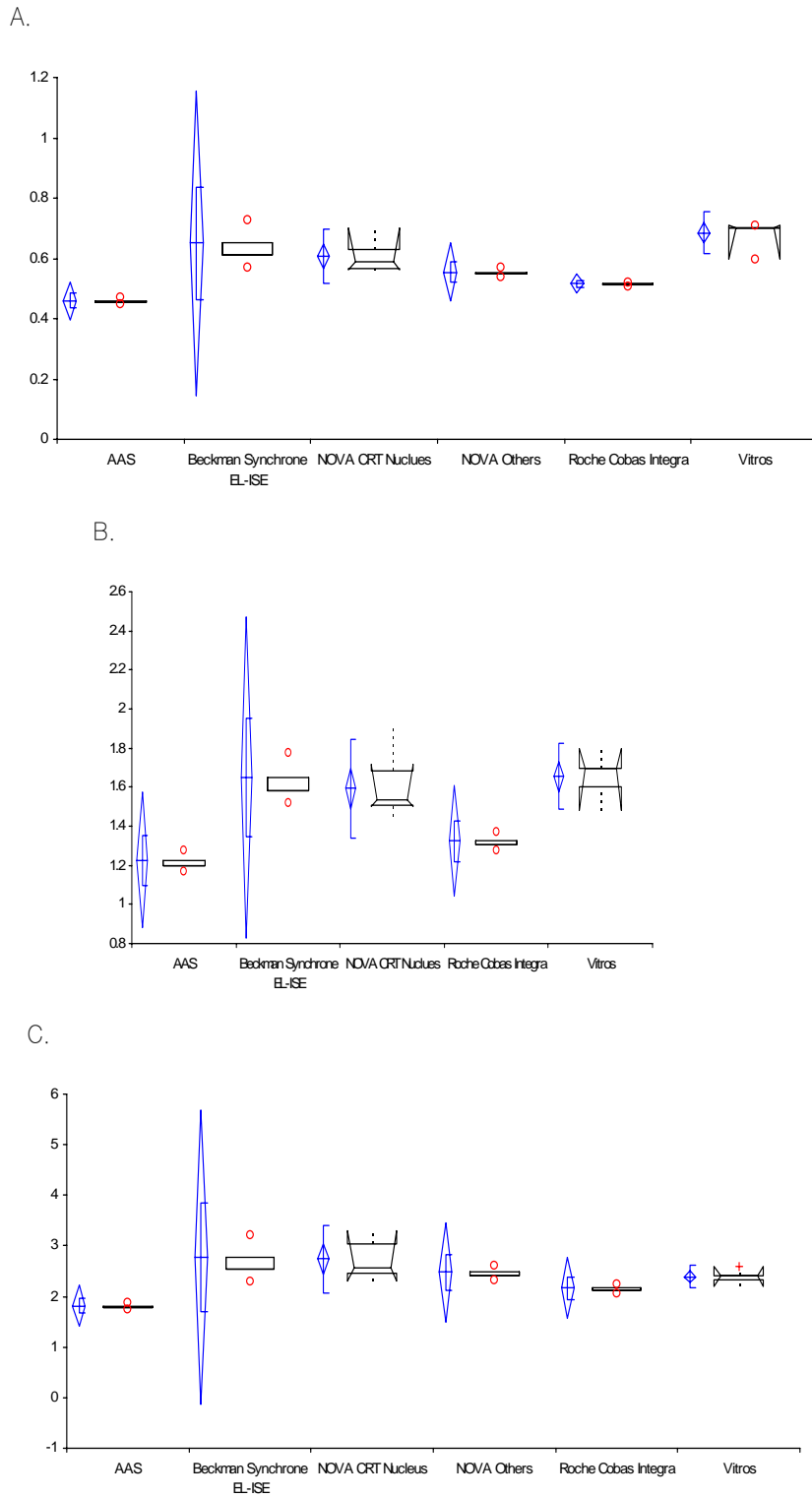


Fig. 8. Lithium results according to the method in TDM proficiency testing in KQACI in the year of 2002. A, DC-02-02 (low level), second trial; B, DC-02-01 (medium level), first trial; C, DC-02-03 (high level), third trial.

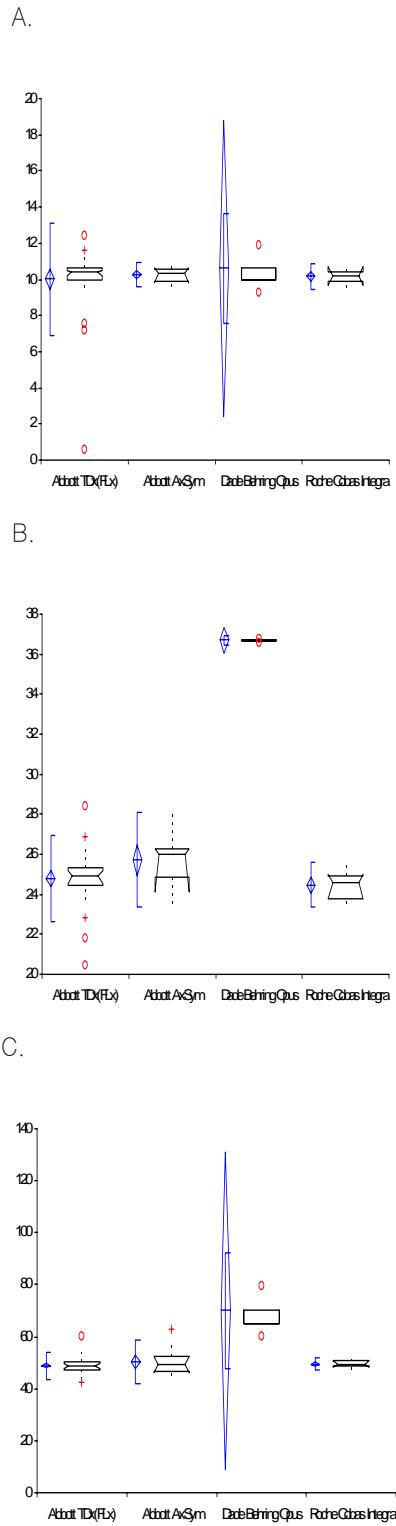
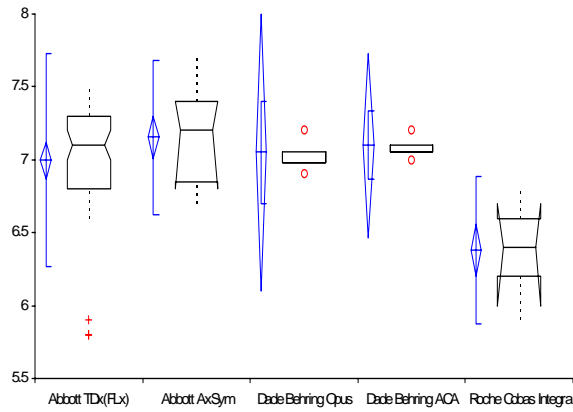
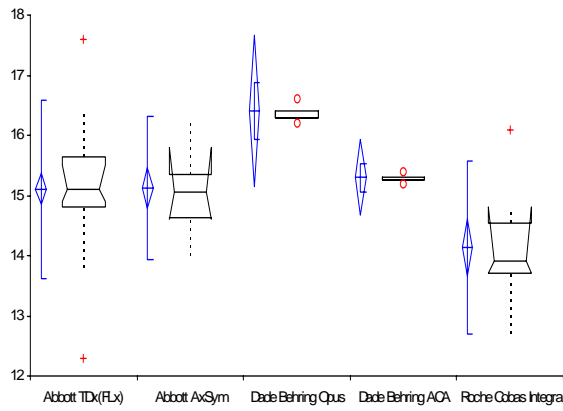


Fig. 9. Phenobarbital results according to the method in TDM proficiency testing in KQACL in the year of 2002. A, DC-02-02 (low level), second trial; B, DC-02-01 (medium level), first trial; C, DC-02-03 (high level), third trial.

A.



B.



C.

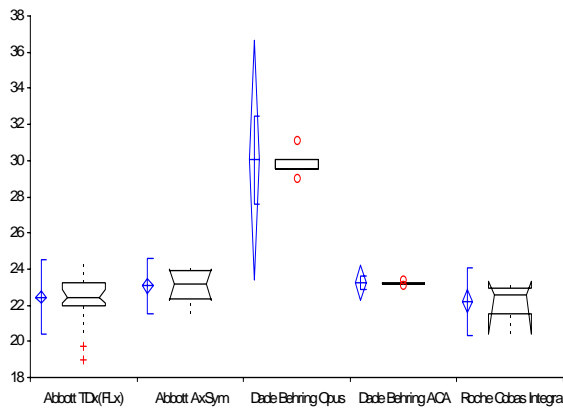


Fig. 10. Phenytoin results according to the method in TDM proficiency testing in KQACL in the year of 2002. A, DC-02-02 (low level), second trial; B, DC-02-01 (medium level), first trial; C, DC-02-03 (high level), third trial.

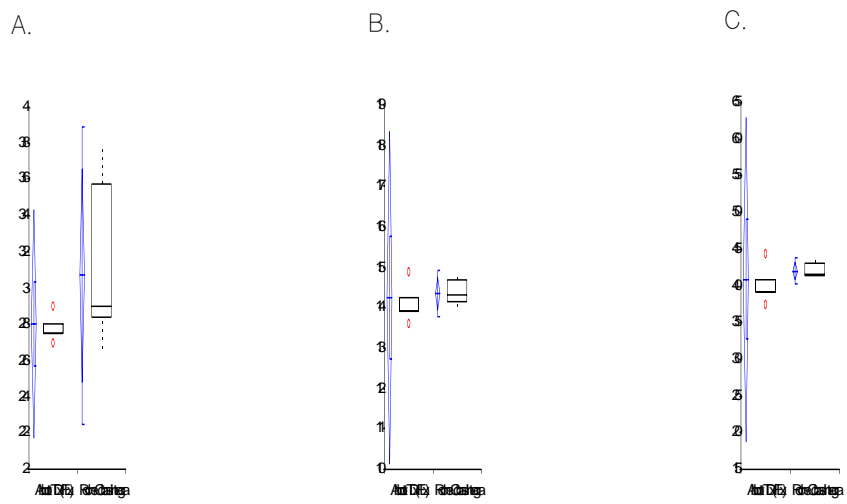
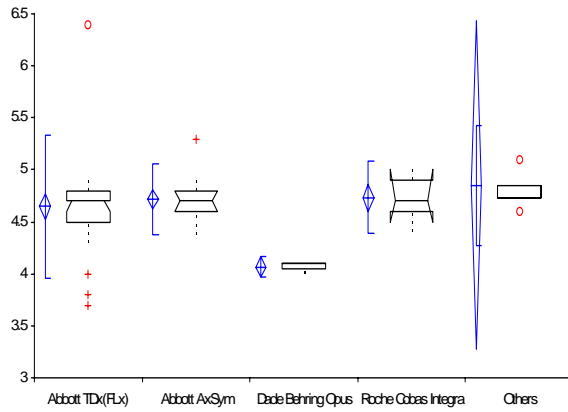
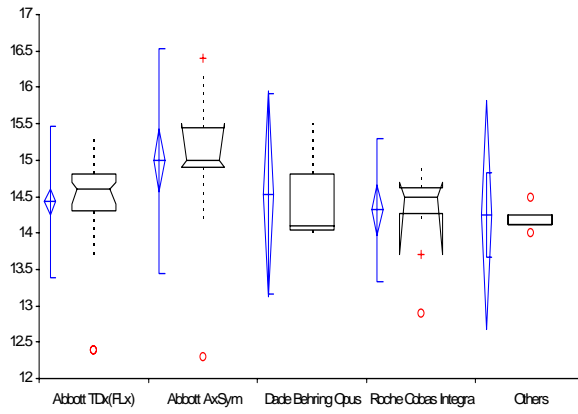


Fig. 11. Salicylate results according to the method in TDM proficiency testing in KAQACL in the year of 2002. A. DC-02-02 (low level), second trial; B, DC-02-01 (medium level), first trial; C, DC-02-03 (high level), third trial.

A.



B.



C.

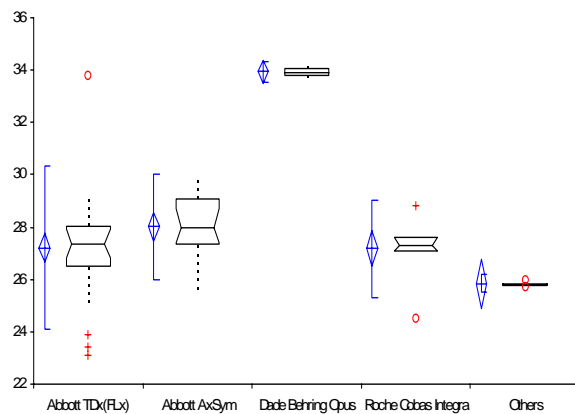


Fig. 12. Theophylline results according to the method in TDM proficiency testing in KQACL in the year of 2002. A, DC-02-02 (low level), second trial; B, DC-02-01 (medium level), first trial; C, DC-02-03 (high level), third trial.

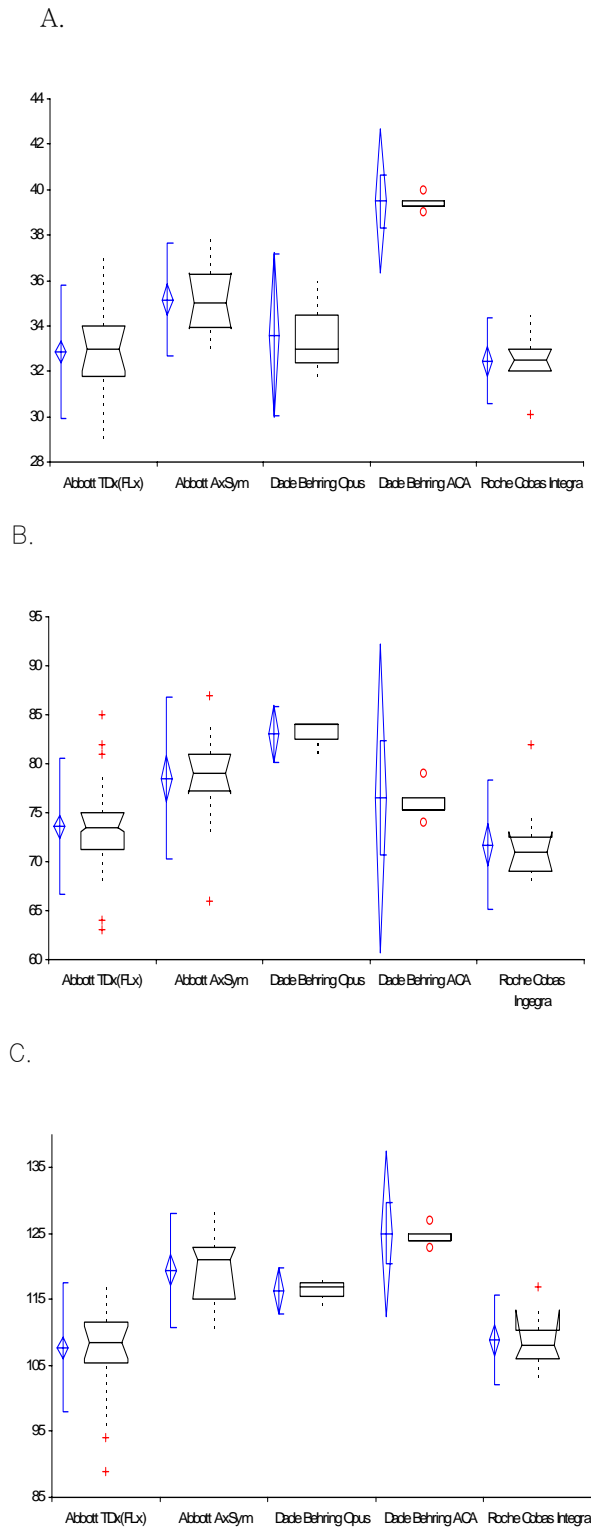


Fig. 13. Valproic acid results according to the method in TDM proficiency testing in KAQACL in the year of 2002. A. DC-02-02 (low level), second trial; B. DC-02-01 (medium level), first trial; C. DC-02-03 (high level), third trial.

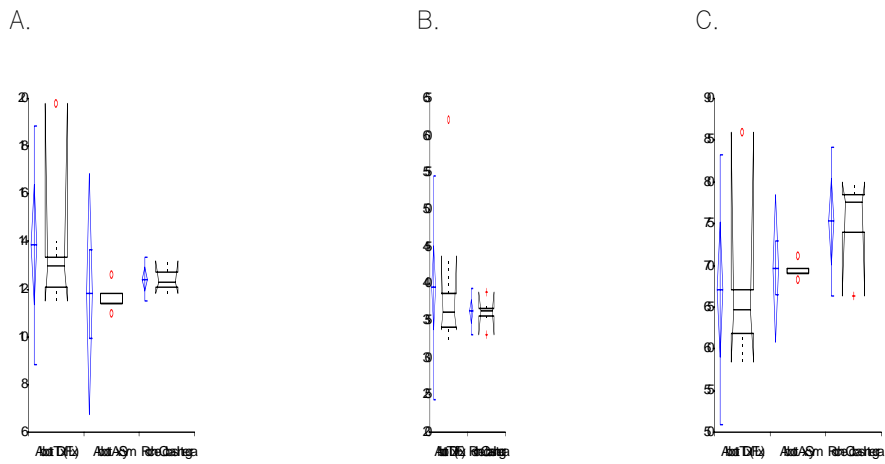


Fig. 14. Vancomycin results according to the method in TDM proficiency testing in KQACL in the year of 2002. A. DC-02-02 (low level), second trial; B. DC-02-01 (medium level), first trial; C. DC-02-03 (high level), third trial. The diamond shows the mean and the 90% confidence interval around the mean. the notched box and whiskers show non-parametric statistics: The notched box shows the median, lower and upper quartiles, and confidence interval around the median. The dotted-line connects the nearest observations within 1.5 IQRs (inter-quartile ranges) of the lower and upper quantiles. Crosses (+) and circles (o) indicate possible outliers-observations more than 1.5 IQRs (near outliers) and 3.0 IQRs (far outliers) from the quantiles.