



External Quality Assessment

Enzyme Analysis for Lysosomal Storage Diseases



Pilots "large scale"

2006 (36)

2007 (46)

2008 (55)

2009 (59), DBS (27)



2010 (58)

2011 (61)

2012 (64)

2013 (71)



ENZYMES 2013 PROFICIENCY TESTING FIBROBLASTS

Hurler/Scheie (MPS I) α -L-iduronidase

Krabbe Galactocerebrosidase **LF2**

Niemann Pick A/B Sphingomyelinase **LF4**

Fabry α -galactosidase

Gaucher β -Glucosidase

Sanfilippo A Heparansulphate sulphamidase **LF6**

MPS VI, Arylsulphatase B

GM₁ (Morquio B) β -Galactosidase

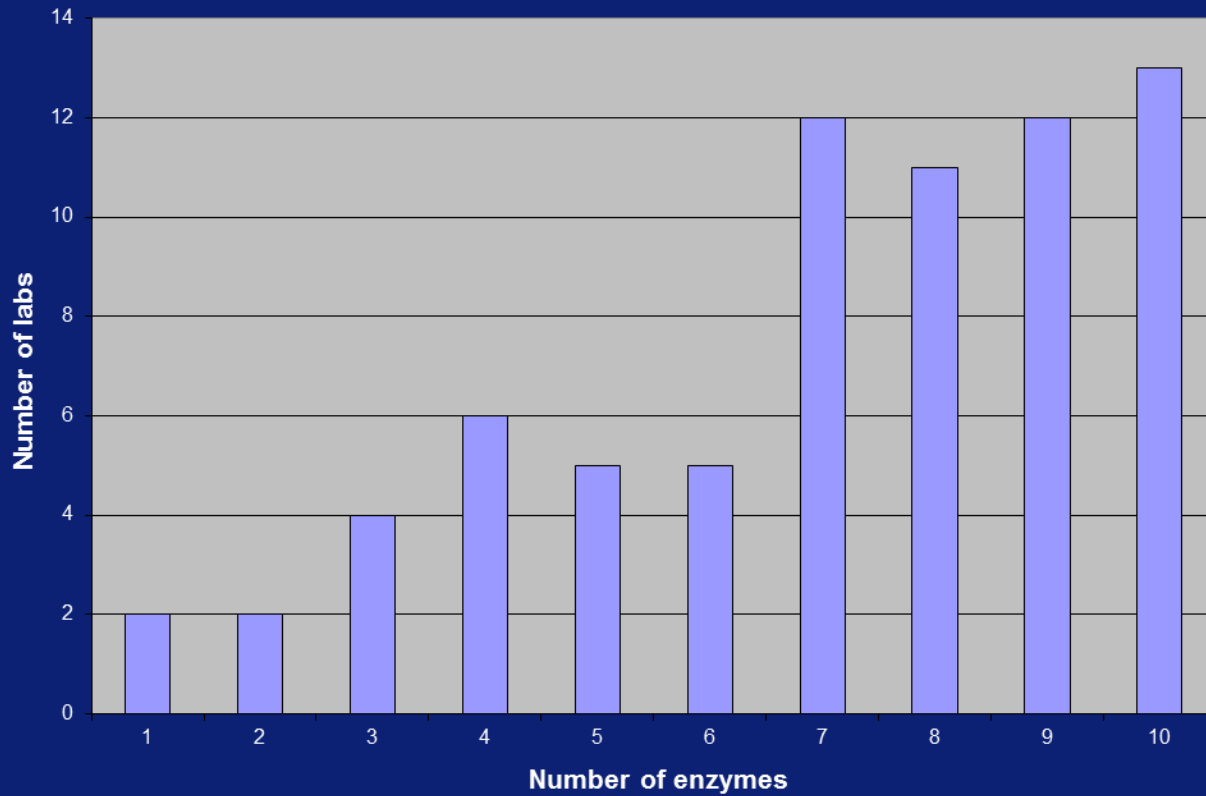
GM₂ β -Hexosaminidase A+B **LF1**

Pompe α -Glucosidase

LF 3 + 5 control Fibroblasts used for determination CV

RESULTS 2013

NUMBER OF ENZYMES MEASURED



Reproducibility of protein/vial 2013 duplicate samples Fibroblasts

1	0
2	178
3	3
4	7
5	10
6	4
7	16
8	12
9	15
10	0
11	0
12	2
13	15
14	25
15	3
16	0
17	15
18	6
19	8

20	1
21	1
22	-
23	38
24	16
25	3
26	0
27	7
28	35
29	16
30	19
31	0
32	-
33	3
34	-
35	13
36	13
37	7
38	3
39	13

40	20
41	11
42	-
43	3
44	7
45	4
46	29
47	1
48	18
49	11
50	1
51	3
52	3
53	-

54	13
55	14
56	4
57	37
58	7
59	1
60	0
61	99
62	5
63	26
64	4
65	10
66	4
67	6
68	-
69	26
70	8
71	95

Mean CV 15.5±27.7 %

N=71	2012	2013
No data	13%	8%
CV<25	91%	79%
CV>25	3%	13%

Reproducibility of Arylsulfatase B 2013 duplicate samples Fibroblasts

1	46
2	3
4	16
5	3
6	35
7	13
8	40
10	117
13	83
14	51
18	8
19	-
20	6
22	-
23	67
24	63
27	62

30	42
31	90
32	-
33	65
34	-
35	42
36	14
37	22
39	10
40	D+
41	114
44	27
45	7
46	42
47	33
48	1
50	33;D+
51	7

54	16:D+
56	20
58	34
59	8
60	1
61	2
64	12
65	34
66	1
68	-
69	2;D+
71	159

D+ enzyme activity
other samples < 20
% control
Fibroblasts

Mean CV 35 ± 36 %

D incorrect 2%

N=48	2012	2013
No data	16%	13%
CV<25	66%	43%
CV>25	27%	45%

Reproducibility of α -Galactosidase 2013 duplicate samples Fibroblasts

1	24
2	6
3	14
5	9
6	7
7	19
8	13
17	104
10	13
11	0
12	11
13	10
14	19
15	7
18	48
19	31

20	1
23	23
24	14
25	1
27	2
28	47
29	7
30	21
31	2
32	-
33	5
34	-
35	74
36	10
37	5
38	193
39	12
41	99
42	-
44	6
45	32

46	24
47	16
48	24
49	1
50	12
51	5
54	9
55	28
56	15
57	10
58	1
59	5
60	0
61	7
63	51
64	1
65	32
66	14
67	9
68	-
69	25
70	93
71	24

N=60	2012	2013
No data	18%	7%
CV<25	76%	73%
CV>25	11%	20%

Mean CV $16 \pm 15\%$
D incorrect 0%

Reproducibility of β -Galactosidase 2013 duplicate samples Fibroblasts

1	36
2	2
3	19
4	7
5	7
6	9
7	94
8	11
10	43
11	14
12	4
13	8
14	19
15	30
16	4
17	27
18	35
19	23
20	11
21	4
22	-
23	54
24	10

25	6
27	36
28	30
29	92
30	49
31	0
32	-
33	16
34	-
35	8
36	2
37	0
38	7
39	88
40	19
41	85
42	-
43	3
44	7
45	40
46	22
47	8
48	13

49	27
50	6
51	11
52	2
53	-
54	12
55	41
56	194;D+
57	8
58	24
59	45
60	11
61	0
62	21
63	106
64	4
65	37
66	36
67	D+
68	-
69	24
70	43
71	140

N=69	2012	2013
No data	19%	10%
CV<25	83%	57%
CV>25	8%	33%

D+ enzyme activity
other Fibroblast < 20 %
control Fibroblast

Mean CV 29 ± 36 %
D incorrect 3%



Reproducibility of α -Glucosidase 2013 duplicate samples Fibroblasts

5	3
6	16
7	64
8	11
10	17
13	38
14	50
15	8
18	40
19	27
20	3
22	-
23	4
24	4

25	4
29	19
30	8
31	86
32	-
34	-
35	56
36	3
37	46
39	63
44	19
45	25
46	49;D+
47	13
48	32

49	30
50	0
51	6
54	2
58	3
59	6
60	7
61	10
63	66
64	3
65	15
66	20
68	-
69	127
71	64

N=44	2012	2013
No data	24%	9%
CV<25	81%	57%
CV>25	10%	34%

D+ enzyme activity
other Fibroblast < 20 %
control Fibroblast

Mean CV 27 ± 28 %
D incorrect 5 %

Reproducibility of β -Glucosidase 2013 duplicate samples Fibroblasts

1	22
2	17
3	4
4	10
5	6
6	11
7	8
8	23
10	12
11	51
13	6
14	19
16	1
17	46
18	6
19	7
20	0
21	40
22	-
23	13
24	2

25	9
27	0
28	23
29	9
30	53
31	15
32	-
33	96
34	-
35	12
36	4
37	6
38	-
39	103
40	65
42	-
44	111
45	75
46	44
47	2
48	15
49	30

50	6
51	19
52	8
53	-
54	8
55	9
56	7
57	34
58	61
59	25
60	3
61	4
63	52
64	6
65	61
66	29
68	-
69	43
70	62
71	117

N=64	2012	2013
No data	21%	11%
CV<25	81%	61%
CV>25	7%	30%

Mean CV $27 \pm 30 \%$
D incorrect 0%

Reproducibility of β -Hexosaminidase A+B 2013 duplicate samples Fibroblasts

1	35
3	19
5	58
6	10
7	27
8	84
10	17
11	52
12	4
13	1
14	13
15	0
17	35;D0
18	3
19	17
20	2
21	9
22	-
23	36
24	77;D+
25	14;D0D+

27	46
28	44
29	7
30	20
31	7;D+
33	50
34	-
35	27
36	4
37	124
38	127
39	27
40	18;D0
41	109
42	-
43	4
44	9
45	13

Mean CV $28 \pm 33\%$
D incorrect 8%

46	0
47	2
48	9
49	3
50	11
51	20
54	15
55	13
56	11
58	28
59	6;D0
60	0
61	4
62	11
63	8
64	4;D+
66	10
67	-
68	-
69	88;D+
70	71
71	93

N=62	2012	2013
No data	14%	8%
CV<25	86%	59%
CV>25	7%	33%

D+ enzyme activity
other Fibroblast < 20
% control Fibroblast

D0 patient sample not
measured

Reproducibility of α -Iduronidase 2013 duplicate samples Fibroblasts

2	8
4	100
5	1
6	9
7	11;D+
8	97
10	15
13	13
14	24
15	18;D+
16	1
17	41
18	23
20	10
22	-
23	1
24	37

25	3
27	38
28	35
30	40
31	140;D+
32	-
33	49
34	-
35	175;D+
36	2
37	38;D+
38	43
40	-
44	36
45	16
46	18
47	2
48	35

49	19
50	93
51	15
53	-
54	18;D+
55	38
56	13
58	55
59	23
60	3
61	4
62	25
63	15;D+
64	16
65	22
68	-
69	4
71	73

N=53	2012	2013
No data	18%	11%
CV<25	86%	55%
CV>25	8%	34%

D+ enzyme activity
other Fibroblast < 20
% control Fibroblast

Mean CV 30 ± 35 %
D incorrect 2 %

Reproducibility of Heparansulphate sulphamidase 2013 duplicate samples Fibroblasts

5	2
7	154;D-
8	4;D-
10	-
13	64
15	-;D0
20	2
24	1;D-

25	-;D0
28	18
30	-
31	-;D0D+
33	60
35	-;D0
36	6
37	-;D0D+

47	15;D-
48	-;D0
51	2
54	-;D0
62	27;D0
63	21
65	85

N=23	2013
No data	39%
CV<25	39%
CV>25	22%

Mean CV 33 ± 44 %
D incorrect 26%

D- enzyme activity
patient sample > 30%
control Fibroblast

D+ enzyme activity
other Fibroblast < 20 %
control Fibroblast

D0 patient sample not
measured

Reproducibility of Galactocerebrosidase 2013 duplicate samples Fibroblasts

5	7;D-
6	18;D-
7	0
8	24;D-
10	-
13	41;D+
15	59;D-
17	67
19	4
20	6
21	112
23	39;D-

25	38;D+
27	28
28	0
31	8
32	-
33	3
35	27
36	2
37	-;D0
38	D-
40	71;D+
45	115
47	34
48	32;D-

49	21
50	118
51	12
55	62
57	6
58	75
59	23;D+
61	7
62	89
63	23;D0
65	11;D-
68	-;D-
69	54
71	79

N=39	2012	2013
No data	21%	10%
CV<25	71%	46%
CV>25	16%	44%

D- enzyme activity
patient sample > 30%
control Fibroblast

D+ enzyme activity
other Fibroblast < 20
% control Fibroblast

D0 patient sample not
measured

Mean CV 38 ± 35 %
D incorrect 33%

Reproducibility of Sphingomyelinase 2013 duplicate samples Fibroblasts

4	9
5	189;D-
6	4
7	21
8	12
10	-
13	20
15	3
17	194
18	1
19	21
20	3
22	-;D0
23	67

24	1;D-
25	87
27	46
28	26
29	-;D0
31	35
33	14
35	5
36	1
37	14
38	-
40	193;D+D0
44	2

45	188
47	11
49	49
50	29
51	15
57	161
58	82
59	10
61	17;D-
62	10
63	-;D0
65	5
68	-
69	13

N=41	2012	2013
No data	23%	15%
CV<25	92%	54%
CV>25	3%	32%

D- enzyme activity patient sample > 30% control Fibroblast

D+ enzyme activity other Fibroblast < 20 % control Fibroblast

D0 patient sample not measured

Mean CV 44 ± 63 %
D incorrect 10%

OVERALL PERFORMANCE 2013

10 Participants: 100% score, CV<25%; enzyme patient<30%; enzyme control >20%

44 Participants: no false negative of positive patients