ERNDIM Administration Office
Manchester Centre for Genomic Medicine
6th floor, St Mary's Hospital
Oxford Road
Manchester
M13 9WL
UK
Email: admin@erndim.org

Scientific Coordination
Dr. G.J.G. Ruijter
Erasmus Medical Center
Dep Clinical Genetics
P.O. Box 2040
3000 CA Rotterdam
The Netherlands
Email: g.ruijter@erasmusmc.nl

Scheme Organisation
CSCQ (Quality Control Centre, Switzerland)
Xavier Albe
2 chemin du Petit-Bel-Air
1225 Chêne-Bourg
Switzerland,
Tel: +41 22 305 52 36
Email: Xavier.Albe@hcuge.ch

Scheme Organisation
Dr. C. Weykamp
Streekziekenhuis Koningin Beatrix
Beatrixpark 1
7101 BN Winterswijk
Netherlands
e-mail: c.w.weykamp@skbwinterswijk.nl

Urine Mucopolysaccharides

Centre: The Netherlands

Final Report 2019

prepared by
Dr. G.J.G. Ruijter and Dr. W. Onkenhout

Note: This annual report is intended for participants of the ERNDIM Urine MPS scheme. The contents should not be used for any publication without permission of the Scientific Advisor.

The fact that your laboratory participates in ERNDIM schemes is not confidential, however, the raw data and performance scores are confidential and will only be shared within ERNDIM for the purpose of evaluating performance of your laboratory, unless ERNDIM is required to disclose performance data by a relevant government agency. For details please see 'ERNDIM Terms and conditions' and the ERNDIM Privacy Policy on www.erndim.org.

1. Introduction

The ERNDIM Urine Mucopolysaccharide scheme offers (1) urine samples obtained from confirmed MPS patients to enable laboratories to gain or maintain experience to identify MPS patients and (2) proficiency testing for laboratories providing urine screening of mucopolysaccharidoses. The scheme is organised by Erasmus Medical Centre (Rotterdam, NL) in conjunction with SKML, the Dutch organisation for quality assurance in medical laboratories (MCA laboratory, Winterswijk, NL) and CSCQ, the Swiss organisation for quality assurance in medical laboratories.

2. Geographical distribution of participants

In 2019, 96 laboratories from many different countries have registered for the Urine MPS scheme. The number of participants is relatively stable over the years (2016: 99, 2017: 102, 2018:100 participants). Two laboratories were educational participants in 2019 (2 in 2018). Educational participants take part in all aspects of the scheme and receive interim reports with scores, but performance is not indicated on the ERNDIM certificate of performance.

Country	Number of participants
Argentina	2
Australia	4
Austria	1
Belgium	4
Brazil	1
Canada	5
Colombia	1
Croatia	1
Cyprus	1
Czechia	1
Denmark	1
Estonia	1
France	7
Germany	8
Hong Kong	1
India	1
Italia	4
Latvia	1
Malaysia	2
Mexico	2
Netherlands	4
New Zealand	2
Norway	1
Poland	1
Portugal	2
Republic of Korea	1
Serbia	1
Singapore	1
Slovakia	1
South Africa	2
Spain	4
Sweden	1
Switzerland	1
Taiwan	1
Turkey	2
United Kingdom	15
United States of America	6
Uruguay	1

3. Design and logistics of the scheme including sample information

The scheme has been designed and planned by dr George Ruijter as Scientific Advisor and coordinated by dr Xavier Albe (sub-contractor on behalf of CSCQ) and dr Cas Weykamp (sub-contractor on behalf of SKML) as scheme organisers, all appointed by and according to procedures laid down the ERNDIM Board.

SKML prepares lyophilised sample aliquots and dispatches UMPS EQA samples to the scheme participants by courier. CSCQ provides a website for on-line submission of results and access to

scheme reports. Existing Urine MPS scheme participants can log on to the CSCQ results submission website at:
https://cscq.hcuge.ch/cscq/ERNDIM/Initial/Initial.php

2 surveys	Round 1: samples 2019-1, 2 and 3
	Round 2: samples 2019-4, 5 and 6

As usual, the samples used in 2019 were authentic human urine samples, 5 from MPS patients and 1 from a non-MPS individual. Two samples were kindly donated by Dr Eresha Jasinge, Lady Ridgeway Hospital for Children, Colombo, Sri Lanka. The other 4 samples were from the sample repository at Erasmus MC, Rotterdam, The Netherlands. Samples were selected by the Scientific Advisor and tested for suitability in the Scientific Advisor's laboratory (Erasmus Medical Centre, Rotterdam, Netherlands). Integrity of the samples was checked after preparation of the lyophilized aliquots in the Scientific Advisor's laboratory before shipment to participants. Details regarding stability of (reconstituted) samples are provided in the sample package.

Sample 1: MPS III A
Sample 2: MPS II
Sample 3: MPS IV A
Sample 4: MPS VI
Sample 5: MPS II
Sample 6: normal

4. Tests

Test required for participation in the Urine MPS scheme are creatinine concentration and GAG analysis (quantitative total GAG and GAG sub fractions, either qualitative by electrophoresis/TLC or quantitative by LC-MS). Participants are asked to interpret the GAG level according to age-matched reference values (i.e. normal or increased), interpret GAG sub fractions (i.e. normal or increased CS, HS, DS and KS) and to give the most likely diagnosis.

5. Schedule of the scheme

- February 2019: shipment of samples
- March 1, 2019: analysis start (survey 1)
- April 1, 2019: website available for result submission (survey 1)
- April 29, 2019: deadline for result submission (survey 1)
- July 4, 2019: interim report of survey 1 available for download
- August 1, 2019: analysis start (survey 2)
- September 2, 2019: website available for result submission (survey 2)
- September 30, 2019: deadline for result submission (survey 2)
- October 30, 2019: interim report of survey 2 available for download
- February 4, 2020: annual report with final scoring, confirmed by the SAB, available for download

6. Results submitted

89 out of the 96 labs that were registered returned results for both surveys.

	Survey 1	**Survey 2**
Receipt of results	90	91
No report	6	5

7. Web site reporting

Website reporting system is compulsory for all participants. Please note, the website includes a section to specify methods. Method specification is required for correct evaluation of the quantitative results (method specific statistics for DMB, harmine, Alcian Blue, CPC, LC-MS/MS test results). Unfortunately, not all participants have specified their methods.

When you are submitting results for the Urine MPS scheme, **please specifiy the methods used by your laboratory to investigate MPS**

In 2017 an evaluation program made by dr Albe from CSCQ was used for the first time to evaluate and score results submitted by participants. The use of this software enabled production of customised interim reports and the annual report, i.e. including scores, for each individual participant.

8. Scoring and evaluation of results

Information regarding procedures for establishment of assigned values, statistical analysis, interpretation of statistical analysis etc. can be found in generic documents on the ERNDIM website. The scoring system has been established by the International Scientific Advisory Board of ERNDIM. Scores are allocated to different elements of the results reported. Two aspects are evaluated: 1) analytical performance, 2) interpretative proficiency. The total score is calculated as a sum of these two aspects. Similar to other qualitative (proficiency testing) ERNDIM schemes, the maximum score for a sample is 4 points. The scores were calculated only for laboratories submitting results.

A	Analytical performance	Correct results of the appropriate tests	2
		Partially correct or missing results	1
		Unsatisfactory or misleading	0
I	Interpretative proficiency	Correct (differential) diagnosis was established	2
		Helpful, but (partially) incorrect	1
		Misleading or wrong diagnosis	0

The specific criteria applied to score the results of the samples included in the 2019 scheme are given under item 9. These criteria have been set by the Scientific Advisor, approved by the Scientific Advisory Board, and have been devised on the basis of (1) for each sample: the type of MPS, (2) current possibilities of routine MPS testing, and (3) actual achievable results for a particular sample. The final decision about scoring is made in the Scientific Advisory Board (SAB) during the autumn meeting (November 21-22, 2019 for the 2019 scheme).

A note on scoring of diagnostic proficiency and the use of **check boxes and the comment box**:
To indicate the most likely diagnosis check boxes must be used to facilitate evaluation of results. The use of the 'comments' box in the website form is recommended to explain your interpretation of results. Comments will be taken into account to score interpretation.
For example we have noted in previous surveys that it may be hard to distinguish MPS I and VI. In the case of increased DS with normal or undetectable HS, checking just the MPS VI box may result in lower than maximum marks if this actually was a MPS I sample. In this case we advise to check the boxes for MPS I, II and VI with a comment, e.g. explaining that MPS VI is more likely. Or alternatively. the MPS VI box could be checked with an explanation in the comments box that MPS I (and perhaps II) cannot be excluded on the basis of the results.

The concept of critical error was introduced in 2014. A critical error is defined as an error resulting from seriously misleading analytical findings and /or interpretations with serious clinical consequences for the patient. Thus labs failing to make a correct diagnosis of a sample considered as eligible for this category will be deemed not to have reached a satisfactory performance even if their total points for the year exceed the limit set at the SAB. . For 2019, the SAB decided that all samples, except MPS2019.03, were eligible for critical error (details provided under item 9).

Score required for satisfactory performance: at least 15 points from the maximum of 24 (62%).

From the 94 regular (non-educational) participants 81 (86%) achieved satisfactory performance (2 reports submitted, score ≥15, no critical error). 13 participants did not accomplish satisfactory performance, including 6 due to incomplete submission of results (i.e. no report or 1 survey report submitted instead of 2 reports).

A certificate of participation, including a statement on performance (satisfactory yes/no) will be issued for participation. In addition, performance support letters will be sent out if the performance is evaluated as unsatisfactory. Seven performance support letters will be sent by the Scientific Advisor (via an online system set up by the ERNDIM Admin office) for the 2019 scheme. Any partial submitters or non-submitters will receive a letter from the ERNDIM Admin office.

9. Results of the samples and evaluation of reporting

9.1. Creatinine and total GAG results of all samples

Quantitative results of creatinine and total GAG were summarised in the two interim reports. Quantitative GAG results were evaluated separately for most methods (DMB, Alcian Blue, Harmine/carbazole, CPC/turbidity). Most participants use DMB (approx. 80%) for quantitative total GAG analysis. The number of participants using other GAG screening methods is smaller.

Parameter/Method	MPS 2019.01	MPS 2019.02	MPS 2019.03	MPS 2019.04	MPS 2019.05	MPS 2019.06
Creatinine (mmol/L)						
Average	4,17	1,97	3,53	5,84	2,55	2,78
SD	0,30	0,18	0,27	0,40	0,24	0,19
Median	4,19	1,98	3,50	5,89	2,56	2,80
N	88	88	86	87	89	86
GAG quantitative (mg/mmol creat) DMB colorimetric method						
Average	43,9	50,5	20,9	15,1	27,0	10,3
SD	14,8	12,8	6,8	3,7	6,8	4,3
Median	42,9	50,7	21,0	14,7	26,9	10,0
N	59	58	57	58	58	58
GAG quantitative (mg/mmol creat) Alcian blue colorimetric tests						
Average	42,4	36,1	21,9	16,3	27,7	12,1
SD	23,1	18,1	10,8	3,6	7,0	6,0
Median	43,4	35,4	21,8	16,6	28,6	10,6
N	6	6	6	6	6	6
GAG quantitative (mg/mmol creat) CPC turbidity method						
Average	43,9	62,3	28,1	30,1	45,7	10,3
SD	15,0	8,0	10,0	5,3	0,8	2,6
Median	50,6	61,6	25,0	30,1	45,7	10,3
N	3	3	3	2	2	2
GAG quantitative (mg/mmol creat) Uronic acids - carbazole/harmine method						
Average	22,2	18,6	6,1	6,2	11,0	3,2
SD	13,7	20,9	6,8	6,3	9,9	2,4
Median	21,9	12,9	2,9	3,4	6,4	2,4
N	5	5	5	5	5	5

9.2. Your results

Parameter/Method	MPS 2019.01	MPS 2019.02	MPS 2019.03	MPS 2019.04	MPS 2019.05	MPS 2019.06
Creatinine (mmol/L)						
GAG quantitative (mg/mmol creat) Uronic acids - carbazole/harmine method						

9.3. Sample 2019.01 – MPS III A

Patient details
MPS IIIA patient with a severe phenotype

Analytical performance
Clearly abnormal sample with strongly elevated total GAG, which was reported by all participants. In

particular HS was elevated (reported by 96% of the labs), but 14 participants (18%) also reported elevated DS. The observation of the presence of DS did not appear to correlate with any particular analysis method.

Diagnosis / Interpretative proficiency
MPS III was reported as the most likely diagnosis by 69 participants. A significant number of participants did report the presence of DS in this sample (14) and concluded various combinations of MPS I, II, III and VII for the diagnosis. This was scored 1 mark, since the presence of DS apparently was substantial. Slightly elevated DS in an MPS III sample may be secondary to lysosomal dysfunction.

Diagnosis	N	%
MPS III	69	82,1
MPS I/MPS II	3	3,6
MPS I	3	3,6
MPS I/MPS II/MPS VII	3	3,6
MPS I/MPS VII	1	1,2
MPS I/MPS II/MPS III/MPS VII	1	1,2
MPS I/MPS III/MPS VII	1	1,2
MPS IV/No Diagnosis	1	1,2
MPS I/MPS II/MPS III/MPS VI/MPS VII	1	1,2
MPS I/MPS III/MPS VI	1	1,2
N results	84	100
N non-submitters	11	
N registered	95	

Scoring
- Analytical results: elevated (total) GAG and elevated HS were each scored 1 point
- Interpretation: MPS III: 2 points. MPS I, II, III, VII in various combinations, when based on elevated DS+HS: 1 point
- Critical error: diagnosis 'normal' (n=0)

Overall proficiency was 89%.

9.4. Sample 2019.02 – MPS II

Patient details
Sample obtained from an MPS II patient with a severe phenotype. Sample taken before start of ERT.

Analytical performance
Abnormal sample with grossly elevated total GAG concentration, similar to sample 2019.01. All but one of the 90 participants that submitted results of GAG screening in this sample reported an elevated concentration (99%). Most participants reported elevated DS and HS; 94% (79/84) reported elevated DS, while 71% (59/83) found elevated HS.

Diagnosis / Interpretative proficiency
The majority of the labs reported MPS I/II (and VII) as the most likely diagnosis (50), while another 23 included MPS VI in the differential diagnosis. In total, 81% mentioned MPS II among the correct possible differential diagnoses. One participant reported ‘normal’ as the most likely diagnosis.

Diagnosis	N	%
MPS I/MPS II	27	31,4
MPS I/MPS II/MPS VII	21	24,4
MPS I/MPS II/MPS VI/MPS VII	15	17,4
MPS I/MPS II/MPS VI	8	9,3
MPS VI	5	5,8

Diagnosis	N	%
MPS IV	2	2,3
MPS II	2	2,3
No Diagnosis	1	1,2
MPS II/MPS III/MPS IV	1	1,2
MPS I/MPS II/MPS III/MPS VI/MPS VII	1	1,2
MPS VI/MPS VII	1	1,2
Normal	1	1,2
MPS III	1	1,2
N results	86	100
N non-submitters	9	
N registered	95	

Scoring
- Analytical results: elevated (total) GAG and elevated DS were each scored 1 mark.
- Interpretation: MPS II with MPS I, VI or VII in various combinations: two points. MPS VI (and VII): 1 point
- Critical error: diagnosis 'normal' (n=1)

Overall proficiency was 89%. In previous samples of severe MPS II patients overall proficiencies were 86% (MPS2018.03), 86% (MPS2017.02) and 83% (MPS2016.05).

9.5. Sample 2019.03 – MPS IV A

Patient details
Sample of a MPS IV A patient, severe phenotype.

Analytical performance
Abnormal GAG screening results were reported by 84/89 participants (94%). 66 of the 77 participants (86%) that submitted a result for GAG subtype analysis reported elevated KS, while elevated chondroitin sulfate was reported by 25%. N-acetyl-galactosamine 6-sulfatase (galactose 6-sufatase) deficiency in MPS IV A may lead to storage of chondroitin-6-sulfate.

Diagnosis / Interpretative proficiency
MPS IV was reported as the most likely diagnosis by 69 participants. Two participants reported MPS IV or normal. Five participants concluded this was a normal sample. Overall proficiency was 82%, which is significantly higher than achieved with previous MPS IV A samples.

Diagnosis	N	%
MPS IV	68	79,1
Normal	5	5,8
No Diagnosis	4	4,7
MPS III	3	3,5
MPS I	1	1,2
MPS III/MPS IV/MPS VI	1	1,2
MPS IV/No Diagnosis	1	1,2
MPS I/MPS II/MPS III/MPS IV/MPS VI/MPS VII	1	1,2
MPS IV/Normal	1	1,2
MPS IV/MPS VI	1	1,2
N results	86	100
N non-submitters	9	

Diagnosis	N	%
N registered	95	

Scoring
- Analytical results: elevated (total) GAG and elevated KS were each scored 1 mark.
- Interpretation: MPS IV: score 2. MPS IV / normal: 1 point
- Critical error: sample not eligible

Overall proficiency was 82%.

9.6. Sample 2019.04 – MPS VI

Patient details
MPS VI sample; patient not treated by ERT

Analytical performance
Increased total GAG was reported by 98% of the participants. 97% of the participating labs found elevated DS. 16% reported elevated HS. This sample was also circulated in 2014 (sample code MPS31) and in 2014 13% of the participants reported HS elevated.

Diagnosis / Interpretative proficiency
All participants concluded this was a sample from an MPS patient. MPS VI was reported as the most likely diagnosis by 35 participants, while another 38 included MPS I/II/VII in the differential diagnosis (various combinations of MPS VI with MPS I, II and VII). In total 73/87 (83%) mentioned MPS VI as a possible diagnosis. In 2014 78% included MPS VI in the possible diagnoses.

Diagnosis	N	%
MPS VI	35	40,2
MPS I/MPS II/MPS VI/MPS VII	20	23,0
MPS I/MPS II/MPS VI	10	11,5
MPS I/MPS II	5	5,7
MPS I/MPS VI	4	4,6
MPS I/MPS II/MPS VII	3	3,4
MPS IV	3	3,4
MPS VI/MPS VII	3	3,4
MPS II/MPS VI/MPS VII	1	1,1
MPS I/MPS II/MPS III/MPS VII	1	1,1
MPS III	1	1,1
MPS II/MPS III/MPS IV/MPS VI	1	1,1
N results	87	100
N non-submitters	9	
N registered	96	

Scoring
- Analytical results: elevated (total) GAG and elevated DS were each scored 1 mark.
- Interpretation: MPS VI with any combination of MPS I, II and VII: score 2. Any combination of MPS I, II and VII: score 1
- Critical error: diagnosis 'normal' (n=0)

Total proficiency was 90%.

9.7. Sample 2019.05 – MPS II

Patient details
Sample from an adult MPS II patient not on ERT

Analytical performance
MPS II sample with strongly elevated total GAG for age. All participants reported elevated total GAG and elevated DS (100%). Increased HS was reported by 72% of the participants.

Diagnosis / Interpretative proficiency
The majority of the labs reported MPS I/II (VII) as the most likely diagnosis (48), while another 24 included MPS VI in the differential diagnosis (various combinations of MPS II with MPS I, VI and VII all scored 2). Five participants reported only MPS II as the diagnosis. MPS I and/or MPS VI was reported by 8 laboratories, 6 of these detected increased DS, but not HS.

Diagnosis	N	%
MPS I/MPS II	26	29,9
MPS I/MPS II/MPS VII	21	24,1
MPS I/MPS II/MPS VI/MPS VII	15	17,2
MPS I/MPS II/MPS VI	8	9,2
MPS II	5	5,7
MPS VI	4	4,6
MPS I	3	3,4
MPS II/MPS IV/MPS VI	1	1,1
MPS I/MPS VI	1	1,1
MPS I/MPS II/MPS III/MPS VII	1	1,1
MPS II/MPS VII	1	1,1
MPS II/MPS VI	1	1,1
N results	87	100
N non-submitters	9	
N registered	96	

Scoring
- Analytical results: elevated (total) GAG and elevated DS were each scored 1 mark.
- Interpretation: MPS II with MPS I, VI or VII in various combinations: two points. MPS I and/or VI (and VII): 1 point
- Critical error: diagnosis 'normal' (n=0)

Overall proficiency was 93%.

9.8. Sample 2019.06 – Normal sample

Patient details
Sample from a patient not suffering from an MPS disorder.

Analytical performance
The majority of the participants (86%) reported normal GAG screening results in this sample (e.g. by DMB test). From the 12 participants that reported abnormal screening results, 9 concluded that this was a normal sample based on GAG subtype analysis. Three laboratories reported a trace of DS, all three by MS GAG analysis.

Diagnosis / Interpretative proficiency
Normal (no MPS) was reported as the diagnosis by 83/89 labs (93%). Four did not report a diagnosis, in one case due to inconclusive test results. One laboratory detected elevated KS and concluded MPS IV.

Diagnosis	N	%
Normal	83	93,3
No Diagnosis	4	4,5
MPS IV/MPS VI/Normal	1	1,1
MPS IV	1	1,1
N results	89	100
N non-submitters	7	
N registered	96	

Scoring

- Analytical results: normal results: score 2.
- Interpretation: normal: two points. No diagnosis due to inconclusive results or 'normal, but MPS not excluded': 1 point
- Critical error: MPS disorder diagnosed (n=1)

Total proficiency based on scores was 96%.

10. Scores of participants

All data transfer, i.e. the submission of data as well as viewing and downloading of reports proceed via the CSCQ results website. The results of your laboratory are confidential and only accessible to you (with your username and password).The anonymous scores of all laboratories are accessible to all participants and only in your version is your laboratory highlighted in the leftmost column.

Detailed scores – **Round 1**

Lab n°	Sample 1 MPS III A			Sample 2 MPS II			Sample 3 MPS IV A			
	A	I	Total	A	I	Total	A	I	Total	Total
1	2	2	4	2	2	4	2	2	4	12
2	--	--	--	--	--	--	--	--	--	0
3	2	2	4	2	2	4	2	2	4	12
4	2	2	4	2	2	4	2	2	4	12
5	2	2	4	2	2	4	2	2	4	12
6	2	2	4	2	2	4	1	2	3	11
7	2	2	4	2	2	4	2	2	4	12
8	2	2	4	2	2	4	2	2	4	12
9	2	2	4	2	2	4	2	2	4	12
10	2	1	3	2	1	3	2	2	4	10
11	2	2	4	2	2	4	2	2	4	12
12	2	2	4	2	2	4	2	2	4	12
13	2	1	3	1	0	1	1	0	1	5
14	2	2	4	2	2	4	2	2	4	12
15	2	1	3	2	2	4	2	2	4	11
16	2	2	4	2	2	4	2	2	4	12
17	2	2	4	2	2	4	2	2	4	12
18	2	2	4	2	2	4	2	2	4	12
19	2	2	4	2	2	4	2	2	4	12
20	2	1	3	2	2	4	2	2	4	11
21	2	2	4	2	2	4	2	2	4	12
22	2	2	4	2	2	4	1	2	3	11
23	2	2	4	2	2	4	2	2	4	12
24	2	1	3	2	2	4	2	0	2	9
25	2	2	4	2	2	4	2	2	4	12
26	1	0	1	2	2	4	2	2	4	9
27	2	2	4	2	2	4	2	2	4	12

Lab n°	Sample 1 MPS III A			Sample 2 MPS II			Sample 3 MPS IV A			
	A	I	Total	A	I	Total	A	I	Total	Total
28	2	2	4	2	2	4	2	2	4	12
29	2	2	4	2	2	4	2	2	4	12
30	2	2	4	2	2	4	2	2	4	12
31	2	2	4	2	2	4	2	2	4	12
32	2	2	4	2	2	4	2	2	4	12
33	2	2	4	2	2	4	2	2	4	12
34	2	2	4	0	0	0	1	2	3	7
35	2	2	4	2	2	4	2	2	4	12
36	2	2	4	2	2	4	2	2	4	12
37	2	2	4	2	2	4	2	2	4	12
38	1	0	1	1	0	1	1	0	1	3
39	2	2	4	2	2	4	1	0	1	9
40	2	2	4	2	2	4	2	2	4	12
41	2	2	4	2	2	4	2	2	4	12
42	2	2	4	2	2	4	2	2	4	12
43	2	2	4	2	2	4	0	0	0	8
44	--	--	--	--	--	--	--	--	--	0
45	2	2	4	2	2	4	2	2	4	12
46	2	2	4	2	2	4	2	2	4	12
47	2	2	4	2	2	4	2	2	4	12
48	2	1	3	2	2	4	2	2	4	11
49	2	2	4	2	2	4	2	2	4	12
50	2	2	4	2	2	4	2	2	4	12
51	2	2	4	2	2	4	2	2	4	12
52	1	0	1	1	0	1	1	0	1	3
53	2	2	4	2	1	3	2	2	4	11
54	2	2	4	2	2	4	1	0	1	9
55	2	2	4	2	2	4	2	2	4	12
56	2	2	4	2	2	4	2	2	4	12
57	2	2	4	2	2	4	2	2	4	12
58	2	2	4	2	2	4	2	2	4	12
59	2	1	3	1	0	1	1	0	1	5
60	2	2	4	2	2	4	1	0	1	9

Lab n°	Sample 1 MPS III A			Sample 2 MPS II			Sample 3 MPS IV A			
	A	I	Total	A	I	Total	A	I	Total	Total
61	1	0	1	2	1	3	1	1	2	6
62	2	2	4	2	2	4	2	2	4	12
63	2	2	4	2	2	4	1	0	1	9
64	2	2	4	2	2	4	2	2	4	12
65	2	2	4	1	0	1	1	0	1	6
66	2	2	4	2	2	4	2	2	4	12
67	2	2	4	2	2	4	0	0	0	8
68	2	2	4	2	2	4	2	2	4	12
69	2	2	4	2	2	4	2	2	4	12
70	2	2	4	2	2	4	1	2	3	11
71	2	2	4	2	2	4	2	2	4	12
72	2	1	3	2	1	3	2	2	4	10
73	2	2	4	2	2	4	2	2	4	12
74	2	2	4	2	2	4	1	2	3	11
75	2	2	4	2	2	4	1	0	1	9
76	--	--	--	--	--	--	--	--	--	0
77	--	--	--	--	--	--	--	--	--	0
78	2	2	4	2	2	4	2	2	4	12
79	2	2	4	2	2	4	2	2	4	12
80	2	1	3	2	0	2	2	2	4	9
81	1	0	1	1	0	1	1	0	1	3
82	2	2	4	2	2	4	2	2	4	12
83	2	2	4	2	2	4	2	2	4	12
84	2	2	4	2	2	4	0	0	0	8
85	1	0	1	2	2	4	2	2	4	9
86	2	1	3	2	1	3	2	2	4	10
87	1	0	1	1	0	1	2	2	4	6
88	2	2	4	2	2	4	2	2	4	12
89	2	1	3	2	2	4	1	0	1	8
90	2	2	4	2	2	4	1	2	3	11
91	2	2	4	2	1	3	1	0	1	8
92	1	0	1	1	0	1	--	--	--	2
93	--	--	--	--	--	--	--	--	--	0

Lab n°	Sample 1 MPS III A			Sample 2 MPS II			Sample 3 MPS IV A			
	A	**I**	**Total**	**A**	**I**	**Total**	**A**	**I**	**Total**	**Total**
94	2	2	4	2	2	4	2	2	4	12
95	1	0	1	1	0	1	1	0	1	3
96	--	--	--	--	--	--	--	--	--	0

Detailed scores – Round 2

Lab n°	Sample 4 MPS VI			Sample 5 MPS II			Sample 6 Normal sample			
	A	I	Total	A	I	Total	A	I	Total	Total
1	2	2	4	2	2	4	2	2	4	12
2	--	--	--	--	--	--	--	--	--	0
3	2	2	4	2	2	4	2	2	4	12
4	2	2	4	2	2	4	2	1	3	11
5	2	2	4	2	2	4	2	2	4	12
6	--	--	--	--	--	--	--	--	--	0
7	2	2	4	2	2	4	2	2	4	12
8	2	2	4	2	2	4	2	2	4	12
9	2	2	4	2	2	4	2	2	4	12
10	2	2	4	2	2	4	2	2	4	12
11	2	2	4	2	2	4	2	2	4	12
12	2	2	4	2	2	4	2	2	4	12
13	2	2	4	2	2	4	2	2	4	12
14	2	2	4	2	2	4	2	2	4	12
15	2	2	4	2	2	4	2	2	4	12
16	2	2	4	2	2	4	2	2	4	12
17	2	2	4	2	2	4	2	2	4	12
18	2	2	4	2	2	4	2	2	4	12
19	2	2	4	2	2	4	2	2	4	12
20	2	2	4	2	2	4	2	2	4	12
21	2	2	4	2	1	3	2	2	4	11
22	2	2	4	2	2	4	2	2	4	12
23	2	2	4	2	2	4	2	2	4	12
24	2	2	4	2	2	4	2	2	4	12
25	2	2	4	2	2	4	2	2	4	12
26	2	2	4	2	2	4	2	2	4	12
27	2	2	4	2	2	4	2	2	4	12
28	2	2	4	2	2	4	2	2	4	12
29	2	2	4	2	2	4	2	2	4	12
30	2	2	4	2	2	4	2	2	4	12

Lab n°	Sample 4 MPS VI			Sample 5 MPS II			Sample 6 Normal sample			
	A	I	Total	A	I	Total	A	I	Total	Total
31	2	2	4	2	1	3	2	2	4	11
32	2	2	4	2	2	4	2	2	4	12
33	2	1	3	2	2	4	2	2	4	11
34	2	2	4	2	2	4	2	2	4	12
35	2	2	4	2	2	4	2	2	4	12
36	2	2	4	2	2	4	2	2	4	12
37	2	2	4	2	2	4	2	2	4	12
38	1	0	1	1	0	1	2	2	4	6
39	1	0	1	2	2	4	2	2	4	9
40	1	0	1	2	2	4	2	2	4	9
41	2	2	4	2	2	4	2	2	4	12
42	2	2	4	2	2	4	2	2	4	12
43	2	2	4	2	2	4	2	2	4	12
44	2	2	4	2	2	4	2	2	4	12
45	2	1	3	2	2	4	2	2	4	11
46	2	2	4	2	2	4	2	2	4	12
47	2	2	4	2	2	4	2	2	4	12
48	1	2	3	2	2	4	2	2	4	11
49	2	2	4	2	2	4	2	2	4	12
50	1	0	1	2	2	4	2	2	4	9
51	2	1	3	2	2	4	2	2	4	11
52	1	0	1	1	0	1	1	0	1	3
53	2	2	4	2	2	4	2	2	4	12
54	2	2	4	2	2	4	2	2	4	12
55	2	2	4	2	2	4	2	2	4	12
56	2	2	4	2	2	4	2	2	4	12
57	2	2	4	2	2	4	2	2	4	12
58	2	2	4	2	2	4	2	2	4	12
59	2	2	4	2	2	4	2	2	4	12
60	2	2	4	2	2	4	2	2	4	12
61	2	1	3	2	2	4	2	2	4	11
62	2	2	4	2	2	4	2	2	4	12
63	2	2	4	2	2	4	2	2	4	12

Lab n°	Sample 4 MPS VI			Sample 5 MPS II			Sample 6 Normal sample			
	A	I	Total	A	I	Total	A	I	Total	Total
64	2	2	4	2	2	4	2	2	4	12
65	2	2	4	2	1	3	2	2	4	11
66	2	2	4	2	2	4	2	2	4	12
67	2	2	4	2	2	4	2	2	4	12
68	2	2	4	2	2	4	2	2	4	12
69	2	2	4	2	1	3	2	2	4	11
70	1	1	2	2	2	4	2	2	4	10
71	2	2	4	2	2	4	2	2	4	12
72	2	2	4	2	2	4	2	2	4	12
73	2	2	4	2	2	4	2	2	4	12
74	2	2	4	2	2	4	2	1	3	11
75	2	0	2	2	0	2	2	2	4	8
76	--	--	--	--	--	--	--	--	--	0
77	2	2	4	2	2	4	2	2	4	12
78	2	2	4	2	1	3	2	2	4	11
79	2	2	4	2	2	4	2	2	4	12
80	2	2	4	2	2	4	2	2	4	12
81	1	0	1	1	0	1	2	2	4	6
82	2	2	4	2	2	4	2	2	4	12
83	2	2	4	2	2	4	2	2	4	12
84	2	2	4	2	1	3	2	2	4	11
85	2	2	4	2	2	4	2	2	4	12
86	1	0	1	2	2	4	2	2	4	9
87	2	2	4	2	1	3	2	0	2	9
88	2	1	3	2	2	4	2	2	4	11
89	2	2	4	2	2	4	2	2	4	12
90	2	2	4	2	2	4	2	2	4	12
91	2	1	3	2	2	4	0	0	0	7
92	1	0	1	1	0	1	1	0	1	3
93	--	--	--	--	--	--	--	--	--	0
94	2	2	4	2	2	4	2	0	2	10
95	1	0	1	1	0	1	2	2	4	6
96	--	--	--	--	--	--	--	--	--	0

Total scores

Lab n°	1	2	3	4	5	6	Cumulative score	Cumulative score (%)	Critical error
1	4	4	4	4	4	4	24	100	
2	--	--	--	--	--	--	0	0	
3	4	4	4	4	4	4	24	100	
4	4	4	4	4	4	3	23	96	
5	4	4	4	4	4	4	24	100	
6	4	4	3	--	--	--	11	46	
7	4	4	4	4	4	4	24	100	
8	4	4	4	4	4	4	24	100	
9	4	4	4	4	4	4	24	100	
10	3	3	4	4	4	4	22	92	
11	4	4	4	4	4	4	24	100	
12	4	4	4	4	4	4	24	100	
13	3	1	1	4	4	4	17	71	
14	4	4	4	4	4	4	24	100	
15	3	4	4	4	4	4	23	96	
16	4	4	4	4	4	4	24	100	
17	4	4	4	4	4	4	24	100	
18	4	4	4	4	4	4	24	100	
19	4	4	4	4	4	4	24	100	
20	3	4	4	4	4	4	23	96	
21	4	4	4	4	3	4	23	96	
22	4	4	3	4	4	4	23	96	
23	4	4	4	4	4	4	24	100	
24	3	4	2	4	4	4	21	88	
25	4	4	4	4	4	4	24	100	
26	1	4	4	4	4	4	21	88	
27	4	4	4	4	4	4	24	100	
28	4	4	4	4	4	4	24	100	
29	4	4	4	4	4	4	24	100	
30	4	4	4	4	4	4	24	100	
31	4	4	4	4	3	4	23	96	
32	4	4	4	4	4	4	24	100	
33	4	4	4	3	4	4	23	96	

Lab n°	1	2	3	4	5	6	Cumulative score	Cumulative score (%)	Critical error
34	4	0	3	4	4	4	19	79	CE
35	4	4	4	4	4	4	24	100	
36	4	4	4	4	4	4	24	100	
37	4	4	4	4	4	4	24	100	
38	1	1	1	1	1	4	9	38	
39	4	4	1	1	4	4	18	75	
40	4	4	4	1	4	4	21	88	
41	4	4	4	4	4	4	24	100	
42	4	4	4	4	4	4	24	100	
43	4	4	0	4	4	4	20	83	
44	--	--	--	4	4	4	12	50	
45	4	4	4	3	4	4	23	96	
46	4	4	4	4	4	4	24	100	
47	4	4	4	4	4	4	24	100	
48	3	4	4	3	4	4	22	92	
49	4	4	4	4	4	4	24	100	
50	4	4	4	1	4	4	21	88	
51	4	4	4	3	4	4	23	96	
52	1	1	1	1	1	1	6	25	
53	4	3	4	4	4	4	23	96	
54	4	4	1	4	4	4	21	88	
55	4	4	4	4	4	4	24	100	
56	4	4	4	4	4	4	24	100	
57	4	4	4	4	4	4	24	100	
58	4	4	4	4	4	4	24	100	
59	3	1	1	4	4	4	17	71	
60	4	4	1	4	4	4	21	88	
61	1	3	2	3	4	4	17	71	
62	4	4	4	4	4	4	24	100	
63	4	4	1	4	4	4	21	88	
64	4	4	4	4	4	4	24	100	
65	4	1	1	4	3	4	17	71	
66	4	4	4	4	4	4	24	100	
67	4	4	0	4	4	4	20	83	

Lab n°	1	2	3	4	5	6	Cumulative score	Cumulative score (%)	Critical error
68	4	4	4	4	4	4	24	100	
69	4	4	4	4	3	4	23	96	
70	4	4	3	2	4	4	21	88	
71	4	4	4	4	4	4	24	100	
72	3	3	4	4	4	4	22	92	
73	4	4	4	4	4	4	24	100	
74	4	4	3	4	4	3	22	92	
75	4	4	1	2	2	4	17	71	
76	--	--	--	--	--	--	0	0	
77	--	--	--	4	4	4	12	50	
78	4	4	4	4	3	4	23	96	
79	4	4	4	4	4	4	24	100	
80	3	2	4	4	4	4	21	88	
81	1	1	1	1	1	4	9	38	
82	4	4	4	4	4	4	24	100	
83	4	4	4	4	4	4	24	100	
84	4	4	0	4	3	4	19	79	
85	1	4	4	4	4	4	21	88	
86	3	3	4	1	4	4	19	79	
87	1	1	4	4	3	2	15	62	
88	4	4	4	3	4	4	23	96	
89	3	4	1	4	4	4	20	83	
90	4	4	3	4	4	4	23	96	
91	4	3	1	3	4	0	15	62	CE
92	1	1	--	1	1	1	5	21	
93	--	--	--	--	--	--	0	0	
94	4	4	4	4	4	2	22	92	
95	1	1	1	1	1	4	9	38	
96	--	--	--	--	--	--	0	0	

Overall Proficiency

Sample	Diagnosis	Analytical (%)	Interpretation (%)	Total (%)
MPS 2019.01	MPS III A	95	84	89
MPS 2019.02	MPS II	94	84	89
MPS 2019.03	MPS IV A	85	79	82
MPS 2019.04	MPS VI	94	85	90
MPS 2019.05	MPS II	97	90	93
MPS 2019.06	Normal sample	98	93	96

11. Tentative schedule for 2020

Sample distribution	February 2020
Start of analysis of Survey 2020-1. Website open	April 1, 2020
Survey 2020-1 - Results submission deadline	April 28, 2020
Survey 2020-1 – Interim reports available	June 2020
Start of analysis of Survey 2020-2	September 1, 2020
Survey 2020-2 – Results submission deadline	September 28, 2020
Survey 2020-2 – Interim reports available	November 2020
Annual Report 2020	January 2021

Date of report, 2020-02-03
Name and signature of Scientific Advisor

Dr. G.J.G. Ruijter
Erasmus Medical Center
Dep Clinical Genetics
P.O. Box 2040
3000 CA Rotterdam
The Netherlands
Email: g.ruijter@erasmusmc.nl