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Urine Mucopolysaccharides

Centre: The Netherlands

Final Report 2023

prepared by
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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.

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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 organized by University Medical Centre Utrecht, the Netherlands in conjunction with MCA, the Dutch organization for quality assurance in medical laboratories (MCA laboratory, Winterswijk, the Netherlands) and CSCQ, the Swiss organization for quality assurance in medical laboratories.

[1] If this report is not Version 1 for this scheme year, go to APPENDIX 1 for details of the changes made since the last version of this document.

2. Geographical distribution of participants

In 2023, 88 laboratories from many different countries have registered for the Urine MPS scheme. The number of participants is relatively stable over the years (2020: 97, 2021: 87, 2022: 88 participants). In 2023 there were no educational participants. 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	5
Brazil	2
Canada	4
Chili	1
Colombia	1
Croatia	1
Cyprus	1
Czech Republic	1
France	5
Germany	10
Hong Kong	1
Italia	5
Latvia	1
Malaysia	2
Netherlands	3
New Zealand	2
Norway	1
People's Republic of China	1
Poland	1
Portugal	2
Singapore	1
South Africa	2
Spain	4
Sweden	1
Switzerland	2
Turkey	2
United Kingdom	13
United States of America	5
Uruguay	1

3. Design and logistics of the scheme including sample information

The scheme has been designed and planned by dr. Berthil Prinsen as Scientific Advisor and coordinated by Dr. Alessandro Salemma and Dr. Nicola Braik (sub-contractors on behalf of CSCQ) and Dr C.W. Weykamp (sub-contractors on behalf of MCA Laboratories) as scheme organizers, all appointed by and according to procedures laid down the ERNDIM Board.

As a subcontractor of ERNDIM, MCA 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 UMPS 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 UMPS-NL-2023-A, B and C
	Round 2: samples UMPS-NL-2023-D, E and F

As usual, the samples used in 2023 were authentic human urine samples, five from MPS patients and one from a non-MPS individual. Three samples were from the sample repository at Erasmus MC, Rotterdam, The Netherlands. Two samples were from the UMC Utrecht, Utrecht, the Netherlands and one sample was obtained from the General University Hospital, Prague, Czech Republic. Samples were selected by the Scientific Advisor and tested for suitability in the Scientific Advisor's laboratory (UMC Utrecht, Utrecht, the 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.

UMPS-NL-2023-A	Female, 22 years	MPS-IV(A)
UMPS-NL-2023-B	Male, 64 years	MPS-I
UMPS-NL-2023-C	Female, 11 years	MPS-III
UMPS-NL-2023-D	Male, 3 years	MPS-I
UMPS-NL-2023-E	Male, 8 years	Control subject
UMPS-NL-2023-F	Male, 5 years	MPS-II

4. Tests

Tests required for participation in the Urine MPS scheme are creatinine analysis and GAG analysis (quantitative total GAG and GAG-subtyping, either qualitative by electrophoresis/TLC or quantitative by mass-spectrometry). Participants are asked to interpret the GAG concentration according to age-matched reference values (i.e normal or increased), interpret GAG subfractions (i.e. normal or increased CS (chondroitin-sulphate), HS (heparan-sulphate), DS (dermatan-sulphate) and KS (keratan-sulphate) and to give the most likely diagnosis.

5. Schedule of the scheme

- 7 February 2023: sample dispatch
- 13 March 2023: analysis start (survey 1)
- 17 April 2023: website available for result submission (survey 1)
- 15 May 2023: deadline for result submission (survey 1)
- 26 June 2023: interim report of survey 1 available for download
- 17 July 2023: analysis start (survey 2)
- 21 August 2023: website available for result submission (survey 2)
- 18 September 2023: deadline for result submission (survey 2)
- 30 October 2023: interim report of survey 2 available for download
- January, 2024: annual report with final scoring, confirmed by the SAB, available for download

6. Results submitted

81 out of the 88 labs that were registered returned results for both surveys.

	Survey 1	**Survey 2**
Receipt of results	84	82
No report	4	6

7. Website 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 and LC-MS/MS test results). Unfortunately, not all participants have specified their methods.

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 can be found in generic documents on the ERNDIM website.
The scoring system has been established by the 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 2023 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 was made in the Scientific Advisory Board (SAB) during the autumn meeting (30th November – 1st December, 2023 in Prague for the 2023 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 MPS VI box and explain in the comments box that MPS I (and perhaps II) cannot be excluded on the basis of the results. Or alternatively the boxes for MPS I, II and VI could be checked with a comment entered explaining that MPS VI is more likely.
It is important to realize, when no diagnosis is selected a comment or recommendation is mandatory that needs to explain why the diagnosis 'no diagnosis' is selected. This information is essential for correct scoring of your samples.

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 2023, the SAB decided that samples UMPS-NL-2023-B, UMPS-NL-2023-C, UMPS-NL-2023-D and UMPS-NL-2021-F were eligible for critical error. For UMPS-NL-2023-A, it was decided to score the sample. UMPS-NL-2023-E (control subject) was not eligible for critical error.

Score required for satisfactory performance: at least 17 points from the maximum of 24 (70%).

From the 88 regular (non-educational) participants 81 participants (92%) submitted results for two rounds of which 76 achieved satisfactory performance (2 reports submitted, score ≥17, no critical error). Twelve participants did not accomplish satisfactory performance, including 7 due to incomplete submission of results (e.g. no results submitted or 1 survey submitted instead of two reports submitted).

Two participants withdraw from the scheme. 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. Five performance support letters were sent by the Scheme Advisor for 2023. Any partial submitters or non-submitters will receive a letter from the ERNDIM 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. 70%) for quantitative total GAG analysis. The number of participants that perform mass-spectrometry related techniques for GAG-analysis is slightly increasing. The exact number is not known.

Parameter/Method	UMPS-NL-2023-A	UMPS-NL-2023-B	UMPS-NL-2023-C	UMPS-NL-2023-D	UMPS-NL-2023-E	UMPS-NL-2023-F
Creatinine (mmol/L)						
Average	2,82	5,18	1,90	2,32	2,41	2,44
SD	0,59	1,28	0,61	0,24	0,20	0,35
Median	2,83	5,27	1,80	2,30	2,40	2,40
N	83	82	83	81	81	81
GAG quantitative (mg/mmol creat) DMB colorimetric method						
Average	11,9	25,2	40,8	57,7	7,0	71,8
SD	4,7	8,2	15,6	17,3	3,0	23,8
Median	11,6	26,6	41,0	58,2	7,0	71,8
N	58	56	59	55	56	56
GAG quantitative (mg/mmol creat) Alcian blue colorimetric tests						
Average	15,0	34,1	48,2	51,7	9,1	59,8
SD	0,0	5,3	10,3	16,5	1,6	18,1
Median	15,0	34,1	48,2	51,7	9,1	59,8
N	2	2	2	2	2	2
GAG quantitative (mg/mmol creat) CPC turbidity method						
Average	11,5	45,8	70,7	73,5	4,2	100,8
SD	4,8	12,2	33,0	58,7	0,2	33,6
Median	11,5	45,8	70,7	73,5	4,2	100,8
N	2	2	2	2	2	2
GAG quantitative (mg/mmol creat) Uronic acids - carbazole/harmine method						
Average	8,0	11,2	27,6	20,3	2,6	24,4
SD	7,8	3,0	19,8	2,4	1,4	5,1
Median	8,0	11,2	27,6	20,3	2,6	24,4
N	2	2	2	2	2	2

9.2. Sample UMPS-NL-2023-A; MPS-IV(A)

Patient details
This urine sample was obtained from a female subject of 22 years old with MPS-IV(A). Diagnosis was confirmed by enzyme testing.

Analytical performance
Abnormal GAG-screening was reported by 65 participants (65/75, 87%). Forty-one participants submitted an increased result for KS (41/69, 59%) and only 17/72 participants (24%) reported an increased amount of CS. Ten participants (10/75, 13%) reported a normal GAG-subtyping, despite an elevated GAG-screening result. Only three participants reported a normal GAG-screening and a normal GAG-subtyping (3/81, 4%). Remarkably 5/73 participants (7%) and 5/73 participants (7%) reported an elevated DS or HS. The analytical performance of this sample was 76%.

Diagnosis / Interpretative proficiency
MPS-IV was reported as the most diagnosis by 48/81 participants (59%). Three participants (3/81, 4%) reported MPS-IV in combination with MPS IV/normal. Four participants (4/81, 5%) reported other combinations of MPS. Twenty-six participants (26/81, 32%) concluded that this samples was a normal sample/no diagnosis. Diagnostic proficiency of the sample was 63% and the overall proficiency was 69%. To conclude, for some participants this urine sample of a patient with MPS-IV(A) was difficult to diagnose. Since this scheme is developed for diagnosis of MPS-patients, the SAB decided to score the sample.

Diagnosis	N	%
MPS IV	48	59,3
Normal	17	21,0
No Diagnosis	9	11,1
MPS IV/Normal	3	3,7
MPS VI	1	1,2
MPS I/MPS II/MPS VI	1	1,2
MPS III/Normal	1	1,2
MPS III	1	1,2
N results	81	100
N non-submitters	13	
N registered	94	

Scoring
- Analytical results: Elevated (total) GAGs and elevated KS or CS were each scored 1 mark.
- Interpretation: MPS-IV was scored 2 marks.
- Critical error: The sample was not considered eligible for critical error.

9.3. Sample UMPS-NL-2023-B; MPS-I

Patient details
This sample was obtained from an adult male (64 years old) with MPS-I. Diagnosis was confirmed by enzyme testing and DNA sequencing of the IDUA gene.

Analytical performance
All participants (74/74, 100%) that performed a GAG-screening did report an abnormal GAG-screening test result (e.g. DMB-test). Elevated DS was reported by 75/78 (96%) participants and 39/74 (53%) participants reported elevated HS. The analytical performance of this sample was 96%.

Diagnosis / Interpretative proficiency
Two participants (3%) concluded that this sample was of a patient with MPS-I. In total 69 participants (86%) reported a differential diagnosis including MPS-I in various combinations with MPS-II, Vl and VII. Six participants, that reported both an abnormal GAG-screening test and abnormal GAG-subtype analysis, lost points with the interpretation. The diagnostic performance of this sample was 84% and total performance was 90%.

Diagnosis	N	%
MPS I/MPS II/MPS VI/MPS VII	23	28,7
MPS I/MPS II/MPS VI	16	20,0
MPS I/MPS II/MPS VII	14	17,5
MPS I/MPS II	9	11,3
MPS VI	6	7,5
MPS I	2	2,5
MPS I/MPS VII	2	2,5
MPS IV	1	1,3
MPS III	1	1,3
MPS II	1	1,3
MPS I/MPS II/MPS III/MPS VI/MPS VII	1	1,3
MPS II/MPS III/MPS VI	1	1,3
No Diagnosis	1	1,3
MPS I/MPS VI	1	1,3
MPS I/MPS VI/MPS VII	1	1,3
N results	80	100
N non-submitters	14	
N registered	94	

Scoring
- Analytical results: Elevated total GAG: 1 mark, elevated DS: 1 mark.
- Interpretation: MPS-I mentioned in the differential diagnosis (based on elevated DS): 2 marks. Combinations of MPS-II, VI or VII based on elevated DS: 1 mark.
- Critical error: Reporting a normal profile was considered as a critical error for this sample (n=0).

9.4. Sample UMPS-NL-2023-C; MPS-III

Patient details
This sample was obtained from a 11 years old female with MPS-III.

Analytical performance
All participants (75/75, 100%) that performed a GAG-screening did report increased total quantitative GAGs. The majority of participants reported elevated HS (74/79, 94%). One participant did not perform a GAG-screening and reported no abnormalities by GAG-subtyping (1/79, 1%). Remarkably 6/74 participants (8%) and 3/74 participants (7%) reported an elevated DS or KS. The analytical performance of this sample was 94%.

Diagnosis / Interpretative proficiency
In total 72/82 participants (88%) reported that this urine was obtained from a patient with MPS-III, while 9 participants (9/82, 11%) reported other combinations of MPS and did not report the correct diagnosis. The report of a normal profile for this sample was considered to be a critical error. The diagnostic performance was 86% and the overall performance was 90% for this sample

Diagnosis	N	%
MPS III	69	84,1
MPS IV	4	4,9
No Diagnosis	3	3,7
MPS III/MPS VII	1	1,2
MPS I/Normal	1	1,2
Normal	1	1,2
MPS I/MPS II/MPS III/MPS VII	1	1,2
MPS I	1	1,2
MPS III/Normal	1	1,2
N results	82	100
N non-submitters	12	
N registered	94	

Scoring
- Analytical results: Elevated (total) GAGs and elevated HS were each scored 1 mark.
- Interpretation: MPS-III was scored 2 marks.
- Critical error: Reporting a normal profile was considered as a critical error for this sample (n=1).

9.5. Sample UMPS-NL-2023-D; MPS-I

Patient details
This sample was obtained from a male subject of 3 years old with MPS-I. Diagnosis was confirmed by enzyme testing and DNA sequencing of the IDUA gene.

Analytical performance
All participants (76/76, 100%) that performed a GAG-screening did report increased total quantitative GAGs. Elevated DS was reported by 78/79 participants (99%) and 41/77 participants (53%) reported elevated HS. The analytical performance of this sample was 98%.

Diagnosis / Interpretative proficiency
Six participants (7%) concluded that this sample was of a patient with MPS-I. In total 67/81 participants (83%) reported a differential diagnosis including MPS-I in various combinations with MPS-II, VI and VII. Eight participants (8/81, 10%), that reported both an abnormal GAG-screening test and abnormal GAG-subtype analysis, lost points with the interpretation. The diagnostic performance of this sample was 92% and total performance was 95%. Urine samples UMPS-NL-2023-B and UMPS-NL-2023-D are both obtained from patients with MPS-I and the scores for both samples are comparable.

Diagnosis	N	%
MPS I/MPS II/MPS VI/MPS VII	27	33,3
MPS I/MPS II	16	19,8
MPS I/MPS II/MPS VII	10	12,3
MPS I/MPS II/MPS VI	10	12,3
MPS I	6	7,4
MPS VI	5	6,2
MPS II/MPS VI	1	1,2
MPS I/MPS II/MPS III/MPS VII	1	1,2
MPS II	1	1,2
MPS I/MPS VI	1	1,2
MPS I/MPS VI/MPS VII	1	1,2

Diagnosis	N	%
MPS I/MPS II/MPS III/MPS VI/MPS VII	1	1,2
No Diagnosis	1	1,2
N results	81	100
N non-submitters	12	
N registered	93	

Scoring
- Analytical results: Elevated total GAG: 1 mark, elevated DS: 1 mark.
- Interpretation: MPS-I mentioned in the differential diagnosis (based on elevated DS): 2 marks. Combinations of MPS-II, VI or VII based on elevated DS: 1 mark.
- Critical error: Reporting a normal profile was considered as a critical error for this sample (n=0).

9.6. Sample UMPS-NL-2023-E; Normal Profile

Patient details
This urine sample was obtained from a healthy boy of 8 years old.

Analytical performance
Most of the participants (71/76, 93%) reported a normal quantitative GAG screening test. However, 5 participants (5/76, 7%) found an increased GAG concentration. Of these 5 participants, one participant reported MPS-IV and one participant MPS-IV/normal as the correct diagnosis, while three participants reported a normal GAG-subtyping and excluded a MPS. Most participants (78/80, 98%) reported normal GAG-subtyping results by GAG-electrophoresis, TLC or mass-spectrometry. The analytical performance of this sample was 95%.

Diagnosis / Interpretative proficiency
As is usual for normal samples, most participants (78/80, 98%) correctly conclude that this was not a sample of a patient with a MPS. One participant concluded that this sample was of a patient with MPS-IV and 1 participant reported MPS-IV/normal. The diagnostic performance was 98% and the overall proficiency of this sample was 96%.

Diagnosis	N	%
Normal	70	87,5
No Diagnosis/Normal	5	6,3
No Diagnosis	3	3,8
MPS IV	1	1,3
MPS IV/Normal	1	1,3
N results	80	100
N non-submitters	13	
N registered	93	

Scoring
- Analytical results: Normal quantitative GAGs and normal GAG-subtyping were each scored 1 mark.
- Interpretation: A normal profile and other combinations with normal profile/no diagnosis were scored 2 marks.
- Critical error: The sample was not considered eligible for critical error.

9.7. Sample UMPS-NL-2023-F; MPS-II

Patient details
This sample was obtained from a male subject of 5 years with MPS-II. Diagnosis was confirmed by enzyme testing.

Analytical performance
In this sample 99% (75/76) of the participants that performed a GAG-screening did report increased total quantitative GAGs. Elevated DS was reported by 76/79 participants (96%) and 72/78 participants (92%) noticed elevated HS as well. The analytical performance of this sample was 98%.

Diagnosis / Interpretative proficiency
In total 74/81 participants (91%) reported that this urine specimen was of a patient with MPS II. Eight participants reported MPS-II (8/81, 10%), while 66/81 participants (81%) reported a differential diagnosis including MPS-II in various combinations with MPS-I, VI and VII. There were 7 participants (7/81, 9%), that reported both an abnormal GAG-screening test and abnormal GAG-subtype analysis but lost points with the interpretation. The diagnostic performance of this sample was 90% and total performance was 94%.

Diagnosis	N	%
MPS I/MPS II/MPS VII	19	23,5
MPS I/MPS II/MPS VI/MPS VII	18	22,2
MPS I/MPS II	17	21,0
MPS I/MPS II/MPS VI	9	11,1
MPS II	8	9,9
MPS III	2	2,5
MPS I	2	2,5
MPS VI/MPS VII	1	1,2
MPS IV	1	1,2
MPS I/MPS II/MPS III/MPS VII	1	1,2
No Diagnosis	1	1,2
MPS I/MPS II/MPS III/MPS VI/MPS VII	1	1,2
MPS II/MPS III	1	1,2
N results	81	100
N non-submitters	12	
N registered	93	

Scoring
- Analytical results: Elevated total GAG: 1 mark, elevated DS: 1 mark.
- Interpretation: MPS-II mentioned in the differential diagnosis (based on elevated DS): 2 marks. Combinations of MPS-I, VI or VII based on elevated DS: 1 mark.
- Critical error: Reporting a normal profile was considered as a critical error for this sample (n=0).

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 of the annual report is your laboratory highlighted in the leftmost column (available from https://cscq.hcuge.ch/cscq/ERNDIM/Initial/Initial.php).

If your laboratory is assigned poor performance and you wish to appeal against this classification please email the ERNDIM Administration Office (admin@erndim.org), with full details of the reason for your appeal, within one month receiving your Performance Support Letter. Details of how to appeal poor performance are included in the Performance Support Letter sent to poor performing laboratories.

Detailed scores – Round 1

Lab n°	Sample 1 This urine sample was obtained from a patient with MPS IV(A).			Sample 2 This urine sample was obtained from patient with MPS I.			Sample 3 This urine sample was obtained from a patient with MPS-III.			
	A	I	Total	A	I	Total	A	I	Total	Total
1	2	2	4	2	2	4	2	2	4	12
2	2	2	4	2	1	3	2	2	4	11
3	1	0	1	2	2	4	2	2	4	9
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	2	2	4	12
7	2	2	4	2	2	4	2	2	4	12
8	--	--	--	--	--	--	--	--	--	0
9	2	2	4	2	2	4	2	2	4	12
10	2	2	4	2	2	4	2	2	4	12
11	1	0	1	2	2	4	2	2	4	9
12	1	0	1	2	2	4	2	2	4	9
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	1	2	3	2	2	4	2	2	4	11
17	2	2	4	2	2	4	2	2	4	12
18	1	0	1	2	2	4	2	2	4	9
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	2	4	2	2	4	12
22	2	2	4	2	2	4	2	2	4	12

Lab n°	Sample 1 This urine sample was obtained from a patient with MPS IV(A).			Sample 2 This urine sample was obtained from patient with MPS I.			Sample 3 This urine sample was obtained from a patient with MPS-III.			
	A	**I**	**Total**	**A**	**I**	**Total**	**A**	**I**	**Total**	**Total**
23	1	0	1	2	2	4	2	2	4	9
24	1	0	1	2	2	4	2	2	4	9
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	1	0	1	2	2	4	2	2	4	9
29	1	0	1	1	0	1	1	0	1	3
30	2	2	4	2	2	4	2	2	4	12
31	0	0	0	2	2	4	2	0	2	6
32	2	2	4	2	2	4	2	2	4	12
33	1	0	1	2	2	4	2	2	4	9
34	1	0	1	1	0	1	1	0	1	3
35	2	2	4	2	2	4	2	2	4	12
36	2	2	4	1	0	1	2	0	2	7
37	2	2	4	2	2	4	2	2	4	12
38	0	0	0	2	0	2	2	2	4	6
39	2	2	4	2	2	4	2	2	4	12
40	0	0	0	2	2	4	2	2	4	8
41	2	2	4	2	2	4	2	2	4	12
42	--	--	--	2	2	4	0	0	0	4
43	2	2	4	2	0	2	2	2	4	10
44	1	0	1	2	2	4	2	2	4	9
45	2	2	4	2	2	4	2	2	4	12
46	1	0	1	2	2	4	2	2	4	9
47	1	2	3	2	2	4	2	2	4	11
48	2	2	4	2	2	4	2	2	4	12
49	1	2	3	2	2	4	2	2	4	11
50	1	0	1	2	2	4	2	2	4	9
51	2	2	4	2	2	4	2	2	4	12
52	1	0	1	2	2	4	2	2	4	9
53	2	2	4	2	2	4	2	2	4	12

Lab n°	Sample 1 This urine sample was obtained from a patient with MPS IV(A).			Sample 2 This urine sample was obtained from patient with MPS I.			Sample 3 This urine sample was obtained from a patient with MPS-III.			
	A	**I**	**Total**	**A**	**I**	**Total**	**A**	**I**	**Total**	**Total**
54	2	0	2	2	2	4	2	2	4	10
55	2	2	4	2	0	2	2	2	4	10
56	1	0	1	2	2	4	2	2	4	9
57	1	2	3	2	0	2	1	0	1	6
58	1	2	3	2	2	4	2	2	4	11
59	1	0	1	2	2	4	2	2	4	9
60	2	2	4	2	0	2	2	2	4	10
61	2	2	4	2	2	4	2	2	4	12
62	1	2	3	2	2	4	2	2	4	11
63	0	0	0	2	2	4	2	2	4	8
64	2	2	4	2	2	4	2	2	4	12
65	1	2	3	2	2	4	2	2	4	11
66	2	2	4	2	2	4	2	2	4	12
67	0	0	0	2	2	4	2	2	4	8
68	2	2	4	2	2	4	2	2	4	12
69	1	0	1	1	0	1	2	0	2	4
70	1	0	1	2	2	4	2	2	4	9
71	0	0	0	2	2	4	1	0	1	5
72	--	--	--	--	--	--	--	--	--	0
73	--	--	--	--	--	--	--	--	--	0
74	2	2	4	2	0	2	2	2	4	10
75	1	0	1	2	2	4	2	2	4	9
76	2	2	4	--	--	--	2	2	4	8
77	2	2	4	2	2	4	2	2	4	12
78	2	2	4	2	2	4	1	0	1	9
79	1	0	1	2	2	4	2	2	4	9
80	2	0	2	2	0	2	2	2	4	8
81	2	2	4	2	2	4	2	2	4	12
82	1	0	1	2	2	4	2	2	4	9
83	1	0	1	2	2	4	1	0	1	6
84	2	2	4	2	2	4	2	2	4	12

Lab n°	Sample 1 This urine sample was obtained from a patient with MPS IV(A).			Sample 2 This urine sample was obtained from patient with MPS I.			Sample 3 This urine sample was obtained from a patient with MPS-III.			
	A	**I**	**Total**	**A**	**I**	**Total**	**A**	**I**	**Total**	**Total**
85	1	0	1	1	0	1	1	0	1	3
86	--	--	--	--	--	--	--	--	--	0
87	1	0	1	1	0	1	1	0	1	3
88	2	2	4	2	2	4	2	2	4	12

Detailed scores – Round 2

Lab n°	Sample 4 This urine sample was obtained of a patient with MPS-I.			Sample 5 This urine sample was obtained from a subject with no indication for an Inborn Error of Metabolism (IEM).			Sample 6 This urine sample was obtained from a patient with MPS-II.			
	A	I	Total	A	I	Total	A	I	Total	Total
1	2	2	4	2	2	4	2	2	4	12
2	2	2	4	2	2	4	2	2	4	12
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	2	2	4	12
7	1	2	3	2	2	4	2	2	4	11
8	--	--	--	--	--	--	--	--	--	0
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	1	3	11
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	1	2	3	2	2	4	11
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	2	2	4	12
23	2	2	4	1	2	3	2	2	4	11
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

Lab n°	Sample 4 This urine sample was obtained of a patient with MPS-I.			Sample 5 This urine sample was obtained from a subject with no indication for an Inborn Error of Metabolism (IEM).			Sample 6 This urine sample was obtained from a patient with MPS-II.			
	A	**I**	**Total**	**A**	**I**	**Total**	**A**	**I**	**Total**	**Total**
29	--	--	--	--	--	--	--	--	--	0
30	--	--	--	--	--	--	--	--	--	0
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	1	2	3	11
34	1	0	1	1	2	3	1	0	1	5
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	2	2	4	2	2	4	2	2	4	12
39	2	2	4	2	2	4	2	2	4	12
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	2	2	4	12
44	2	2	4	2	2	4	2	2	4	12
45	2	2	4	2	2	4	2	2	4	12
46	2	2	4	2	2	4	2	2	4	12
47	2	0	2	2	2	4	2	0	2	8
48	2	2	4	2	2	4	2	2	4	12
49	2	2	4	2	2	4	2	2	4	12
50	2	1	3	2	2	4	2	2	4	11
51	2	2	4	2	2	4	2	2	4	12
52	2	2	4	2	2	4	2	2	4	12
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	1	3	2	2	4	2	2	4	11
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

Lab n°	Sample 4 This urine sample was obtained of a patient with MPS-I.			Sample 5 This urine sample was obtained from a subject with no indication for an Inborn Error of Metabolism (IEM).			Sample 6 This urine sample was obtained from a patient with MPS-II.			
	A	**I**	**Total**	**A**	**I**	**Total**	**A**	**I**	**Total**	**Total**
60	2	0	2	2	2	4	2	2	4	10
61	2	2	4	2	2	4	2	2	4	12
62	2	2	4	2	2	4	1	0	1	9
63	2	2	4	2	2	4	2	2	4	12
64	2	2	4	2	2	4	2	2	4	12
65	2	2	4	2	2	4	2	2	4	12
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	2	4	1	0	1	9
70	2	2	4	1	2	3	2	2	4	11
71	2	2	4	0	0	0	2	2	4	8
72	--	--	--	--	--	--	--	--	--	0
73	--	--	--	--	--	--	--	--	--	0
74	2	2	4	2	2	4	2	2	2	12
75	2	2	4	2	2	4	2	2	4	12
76	2	0	2	2	2	4	2	2	4	10
77	2	2	4	2	2	4	2	2	4	12
78	2	2	4	2	2	4	1	0	1	9
79	2	2	4	1	2	3	2	0	2	9
80	2	2	4	2	2	4	2	2	4	12
81	2	2	4	2	2	4	2	2	4	12
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	2	2	4	12
85	1	0	1	1	0	1	1	0	1	3
86	2	1	3	2	2	4	2	2	4	11
87	--	--	--	--	--	--	--	--	--	0
88	2	2	4	2	2	4	2	2	4	12

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	4	3	4	4	4	4	23	96	
3	1	4	4	4	4	4	21	88	
4	4	4	4	4	4	4	24	100	
5	4	4	4	4	4	4	24	100	
6	4	4	4	4	4	4	24	100	
7	4	4	4	3	4	4	23	96	
8	--	--	--	--	--	--	0	0	
9	4	4	4	4	4	4	24	100	
10	4	4	4	4	4	4	24	100	
11	1	4	4	4	4	4	21	88	
12	1	4	4	4	4	4	21	88	
13	4	4	4	4	4	3	23	96	
14	4	4	4	4	4	4	24	100	
15	4	4	4	4	4	4	24	100	
16	3	4	4	4	4	4	23	96	
17	4	4	4	4	3	4	23	96	
18	1	4	4	4	4	4	21	88	
19	4	4	4	4	4	4	24	100	
20	4	4	4	3	4	4	23	96	
21	4	4	4	4	4	4	24	100	
22	4	4	4	4	4	4	24	100	
23	1	4	4	4	3	4	20	83	
24	1	4	4	4	4	4	21	88	
25	4	4	4	4	4	4	24	100	
26	4	4	4	4	4	4	24	100	
27	4	4	4	4	4	4	24	100	
28	1	4	4	4	4	4	21	88	
29	1	1	1	--	--	--	3	12	
30	4	4	4	--	--	--	12	50	
31	0	4	2	4	4	4	18	75	
32	4	4	4	4	4	4	24	100	
33	1	4	4	4	4	3	20	83	

Lab n°	1	2	3	4	5	6	Cumulative score	Cumulative score (%)	Critical error
34	1	1	1	1	3	1	8	33	
35	4	4	4	4	4	4	24	100	
36	4	1	2	4	4	4	19	79	
37	4	4	4	4	4	4	24	100	
38	0	2	4	4	4	4	18	75	
39	4	4	4	4	4	4	24	100	
40	0	4	4	4	4	4	20	83	
41	4	4	4	4	4	4	24	100	
42	--	4	0	4	4	4	16	67	CE
43	4	2	4	4	4	4	22	92	
44	1	4	4	4	4	4	21	88	
45	4	4	4	4	4	4	24	100	
46	1	4	4	4	4	4	21	88	
47	3	4	4	2	4	2	19	79	
48	4	4	4	4	4	4	24	100	
49	3	4	4	4	4	4	23	96	
50	1	4	4	3	4	4	20	83	
51	4	4	4	4	4	4	24	100	
52	1	4	4	4	4	4	21	88	
53	4	4	4	4	4	4	24	100	
54	2	4	4	4	4	4	22	92	
55	4	2	4	4	4	4	22	92	
56	1	4	4	3	4	4	20	83	
57	3	2	1	4	4	4	18	75	
58	3	4	4	4	4	4	23	96	
59	1	4	4	4	4	4	21	88	
60	4	2	4	2	4	4	20	83	
61	4	4	4	4	4	4	24	100	
62	3	4	4	4	4	1	20	83	
63	0	4	4	4	4	4	20	83	
64	4	4	4	4	4	4	24	100	
65	3	4	4	4	4	4	23	96	
66	4	4	4	4	4	4	24	100	
67	0	4	4	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	1	1	2	4	4	1	13	54	
70	1	4	4	4	3	4	20	83	
71	0	4	1	4	0	4	13	54	
72	--	--	--	--	--	--	0	0	
73	--	--	--	--	--	--	0	0	
74	4	2	4	4	4	4	22	92	
75	1	4	4	4	4	4	21	88	
76	4	--	4	2	4	4	18	75	
77	4	4	4	4	4	4	24	100	
78	4	4	1	4	4	1	18	75	
79	1	4	4	4	3	2	18	75	
80	2	2	4	4	4	4	20	83	
81	4	4	4	4	4	4	24	100	
82	1	4	4	4	4	4	21	88	
83	1	4	1	4	4	4	18	75	
84	4	4	4	4	4	4	24	100	
85	1	1	1	1	1	1	6	25	
86	--	--	--	3	4	4	11	46	
87	1	1	1	--	--	--	3	12	
88	4	4	4	4	4	4	24	100	

Performance

	Number of labs	% total labs
Satisfactory performers (≥ 70 % of adequate responses)	76	86
Unsatisfactory performers (< 70 % adequate responses and/or critical error)	5	6
Partial and non-submitters	7	8

Overall Proficiency

Sample	Diagnosis	Analytical (%)	Interpretation (%)	Total (%)
UMPS-NL-2023-A	MPS-IV(A)	**76**	**63**	**69**
UMPS-NL-2023-B	MPS-I	**96**	**84**	**90**
UMPS-NL-2023-C	MPS-III	**94**	**86**	**90**
UMPS-NL-2023-D	MPS-I	**98**	**92**	**95**
UMPS-NL-2023-E	Control subject	**95**	**98**	**96**
UMPS-NL-2023-F	MPS-II	**98**	**91**	**94**

11. Tentative schedule for 2024

Sample distribution	6 February
Start of analysis of Survey 2024-1 (website open)	15 April
Survey 2024-1 - Results submission deadline	13 May
Survey 2024-1 – Interim Reports	June
Start of analysis of Survey 2024-2 (website open)	12 August
Survey 2024-2 – Results submission deadline	9 September
Survey 2024-2 – Interim Reports	October
Annual Report 2024	December 2024/January 2025

12. ERNDIM certificate of participation

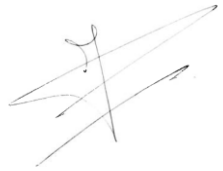
A combined certificate of participation covering all EQA schemes will be provided to all participants who take part in any ERNDIM scheme. For the UMPS scheme this certificate will indicate if results were submitted and whether satisfactory performance was achieved in the scheme.

13. Questions, Comments and Suggestions

If you have any questions, comments or suggestions please address to the Scientific Advisor of the scheme, NAME (EMAIL) and/or to the ERNDIM Administration Office (admin@erndim.org)

Please read:
The urine samples in this scheme are obtained from MPS-patients that are confirmed by enzyme testing or DNA-analysis. We notice that it is very difficult to obtain sufficient urine of MPS-patients (off treatment). If you have an urine sample of a MPS patient available, please do contact the scientific advisors (Dr. H.C.M.T. Prinsen and Dr. G.J.G. Ruijter). When the sample is suitable and selected for this scheme, your laboratory gets a discount for the next year.

Date of report, 2024-02-29



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APPENDIX 1. Change log (changes since the last version)

Version Number	Published	Amendments
1	01 February 2024	2023 annual report published
2	29 February 2024	Adapted the score for sample UMPS-NL-2023-F for lab 74.

END