

Supplementary material to

## **A precise performance-based reimbursement model for the multi-centre NAPKON cohorts – development and evaluation**

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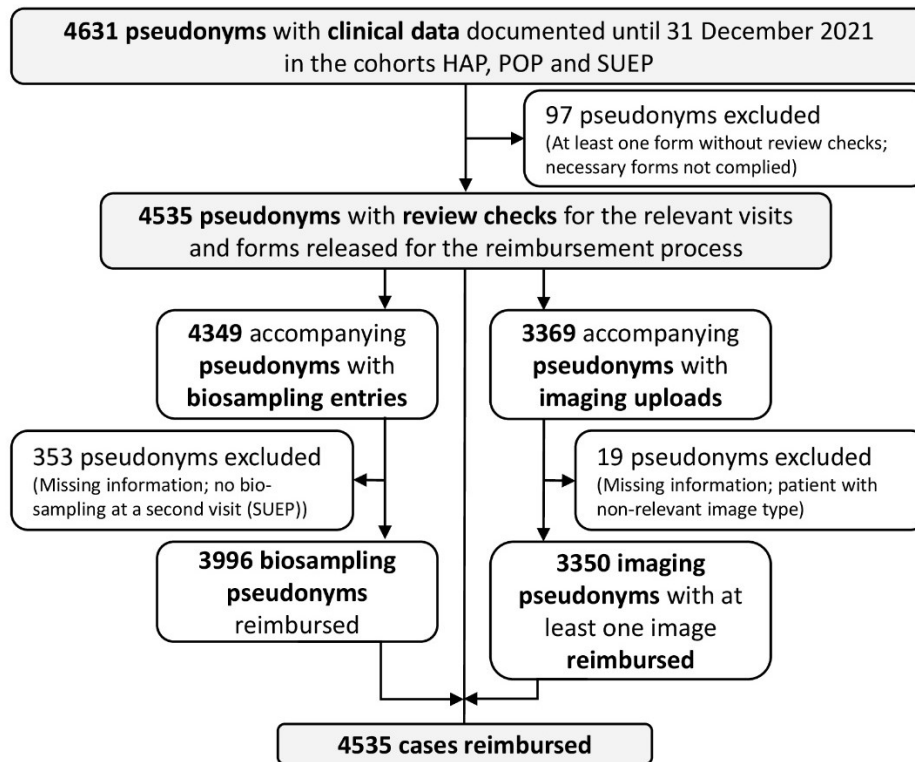
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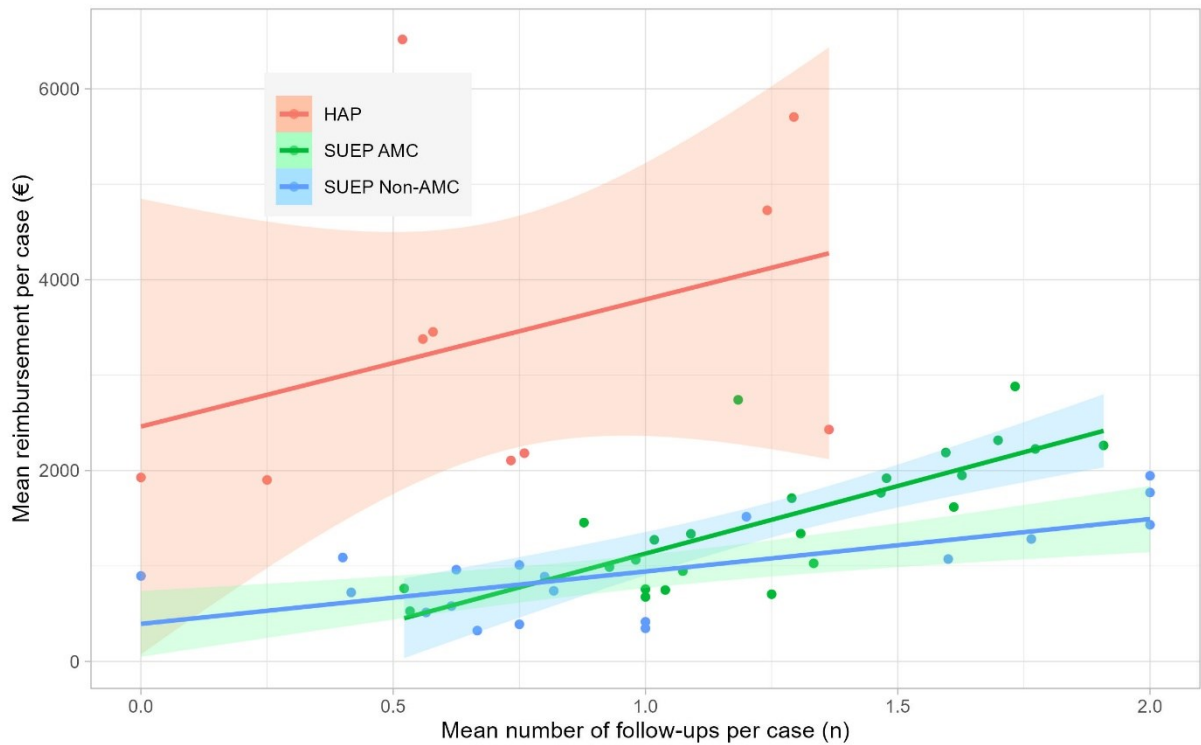
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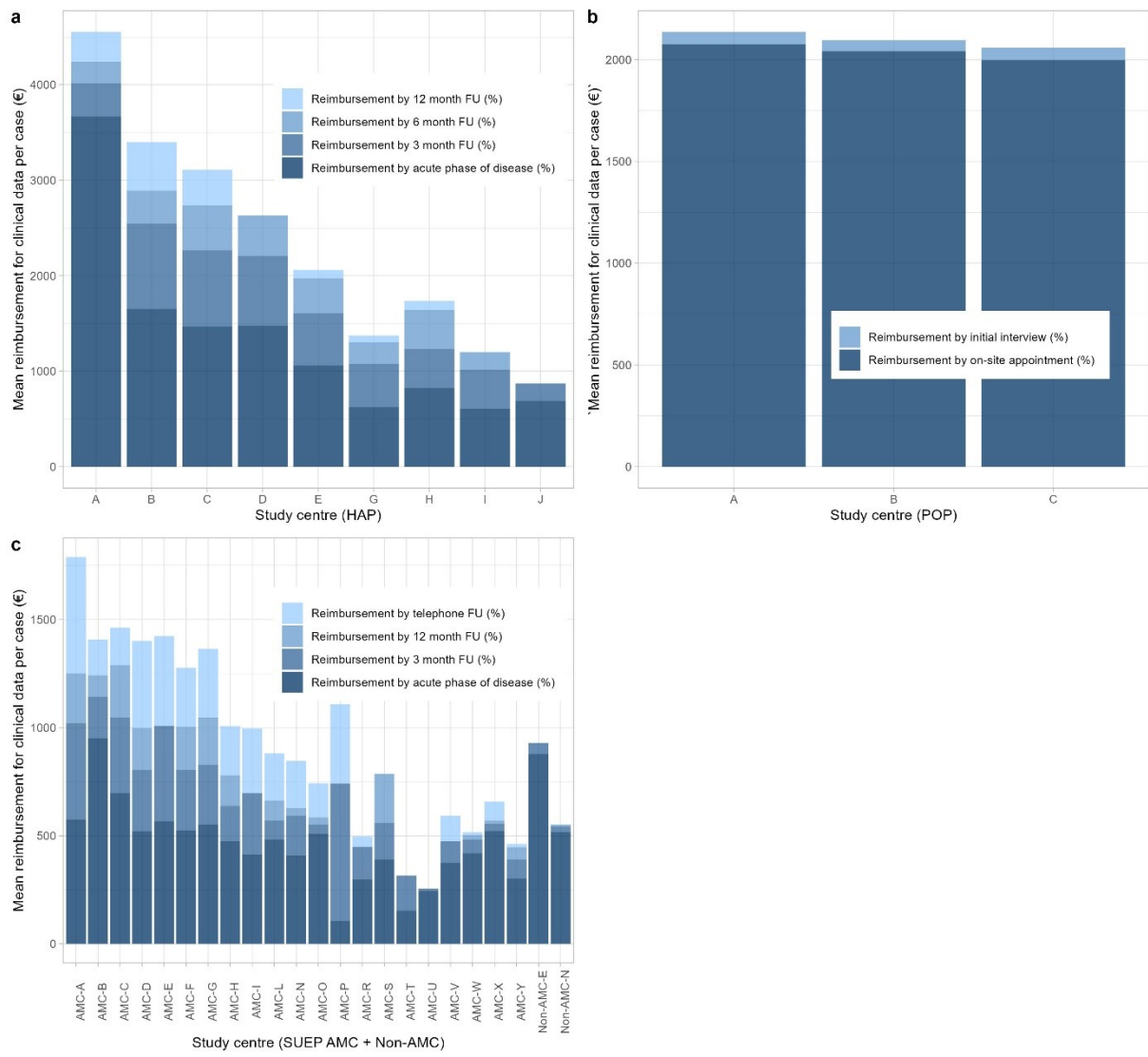
**Figure S1.** Flowchart of reimbursed cases and reasons for exclusion.

For each data management system, a different set of rules for quality assurance and validation is applied. Pseudonyms who did not fulfil these criteria could not be reimbursed. The reimbursement of the clinical data is the prerequisite for the accompanying reimbursement of the image uploads and biosampling for each accompanying pseudonym (different pseudonyms in each data management system). As biosampling is not feasible or images are not available (and planned) for some participating (non-university) study sites, there are less pseudonyms in the imaging or biosampling management system than in the clinical data management system, especially in the SUEP cohort. High-Resolution Platform (HAP); Population-Based Platform (POP); Cross-Sectoral Platform (SUEP).



**Figure S2.** Mean reimbursement per case increases with the number of follow-ups.

The relationship between the average reimbursement per case and mean number of follow ups is displayed using a regression line and standard error by platform. We observed a positive correlation (Pearson's correlation coefficient) for clinical data reimbursement with compliance to the FU for the SUEP (SUEP AMC:  $r=0.77$ ,  $p<0.001$ ; SUEP non-AMC:  $r=0.69$ ,  $p=0.001$ ). The variance in the HAP FUs was high ( $r=0.36$ ,  $p=0.308$ ). The Population-Based Platform did not have a follow-up in the first funding period. High-Resolution Platform (HAP); Cross-Sectoral Platform academic medical centres (SUEP AMC); Cross-Sectoral Platform non-academic medical centres (SUEP AMC).



**Figure S3.** Contribution of visit types in the course of disease to total clinical documentation-based reimbursement of each study centre.

Each colour shaded section reflects the types of visits applicable by the respective study protocol of the cohort. Section (a) and (b) show the composition of HAP and POP, SUEP non-AMC are embedded together with SUEP AMC in (c), as there are few centres with finished cases. Due to the longitudinal design, the follow-up visits of certain cases might not have been applicable. This depiction only includes cases who had the chance to participate in all follow-up visits. Follow-up (FU); High-Resolution Platform (HAP); Population-Based Platform (POP); Cross-Sectoral Platform academic medical centre (SUEP AMC); Cross-Sectoral Platform non-academic medical centre (SUEP Non-AMC).

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Betreff: 01KX2021; NUM Case Fees; NAPKON; IA 88116131 (NAPKON)

## **Einzelpatient:innennachweis für Zentrum [REDACTED]**

Dokument-Nummer: 2204051-0206-0001

**05.04.2022**

Patient:innen ID: pheno\_ [REDACTED]

		<b>Leistungen</b>	<b>Einzelvergütung</b>	<b>Abgerechnete Anzahl</b>	<b>Gesamte Vergütung</b>
<b>Datum</b>					
<b>25.02.2021</b>	<b>1</b>	Doku Allgemein Screening + Baseline	115,29	1	115,29
	<b>2</b>	Entscheidung über Studieneinschluss	5,59	1	5,59
	<b>3</b>	Patient*inneninformation, Einwilligung	32,33	1	32,33
	<b>4</b>	Prüfung Ein- und Ausschlusskriterien	26,76	1	26,76
<b>01.03.2021</b>	<b>5</b>	Doku Allgemein Visite Normalstation	66,15	1	66,15
<b>05.03.2021</b>	<b>6</b>	Doku Allgemein Visite Normalstation	66,15	1	66,15
<b>12.04.2021</b>	<b>7</b>	Doku Allgemein Telefon-Follow-Up	20,79	1	20,79
	<b>8</b>	Mindestpauschale PROM	22,71	1	22,71
	<b>9</b>	Terminvereinbarung Patient:in	8,25	1	8,25

**Gesamtkosten: 364,02 €**

**Figure S4.** Exemplary reimbursement document provided to the NAPKON study centres on the single patient level.

Additionally, an aggregation by centre (Figure S5) and an aggregation by platform is provided, respectively.



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**Leistungsübersicht für [REDACTED]**

Dokument-Nummer: 2204051-0209-0001 **05.04.2022**

**Leistungsübersicht:**

	Aktivität	Einzelvergütung	Abgerechnete Anzahl	Gesamte Vergütung
1	Arbeitsfähigkeit (2/6)	13,62	3	13,62
2	Arbeitsfähigkeit (3/6)	13,62	2	13,62
3	Arbeitsfähigkeit (4/6)	13,62	21	190,68
4	Arbeitsfähigkeit (5/6)	13,62	3	34,05
5	CT-Kranial	28,53	4	114,12
6	CT-Körperregion unsicher	28,53	8	228,24
7	CT-Thorax	28,53	3	85,59
8	Doku Allgemein Screening + Baseline	115,29	59	6.802,11
9	Doku Allgemein Telefon-Follow-Up	20,79	4	83,16
10	Doku Allgemein Visite Ambulant	66,15	3	198,45
11	Doku Allgemein Visite Intensivstation	122,86	40	4.914,40
12	Doku Allgemein Visite Normalstation	66,15	86	5.688,90
13	EQ-5D-5L	13,62	32	435,84
14	Entscheidung über Studieneinschluss	5,59	60	335,40
15	PHQ-4	9,08	32	290,56
16	PROMIS Global Health	22,71	32	726,72
17	PROMIS Kognitive Funktion	9,08	32	290,56

	Aktivität	Einzelvergütung	Abgerechnete Anzahl	Gesamte Vergütung
18	Patient*inneninformation, Einwilligung	32,33	60	1.939,80
19	Prüfung Ein- und Ausschlusskriterien	26,76	60	1.605,60
20	Röntgen-Thorax	28,53	60	1.711,80
21	Screeningfragen zu Schmerz, Dyspnoe, Fatigue	24,97	1	24,97
22	Screeningfragen zu Schmerz, Dyspnoe, Fatigue (10/11)	24,97	8	181,60
23	Screeningfragen zu Schmerz, Dyspnoe, Fatigue (3/11)	24,97	23	156,63
24	Terminvereinbarung Patient:in	8,25	35	288,75
25	Vitalzeichenkontrolle	5,50	2	11,00

<b>Kumulierte Kosten: 26.366,17 €</b>
<b>Projektpauschalen 20%: 5.273,23 €</b>
<b>Kumulierte Gesamtkosten: 31.639,40 €</b>
<b>Entsprechung in Standardfällen (2.904,67 €): 10,89</b>
<b>Gesamtkosten für 11 Standardfälle : 31.951,37 €</b>

Weitere Informationen über zukünftig projizierte Kosten werden separat ausgewiesen.

**Enthaltene Pseudonyme:**

Abz. Anzahl der Fälle 60



**Figure S5.** Exemplary reimbursement documents provided to the NAPKON study centres on the centre aggregation level.

Additionally, a single patient overview and an aggregation by platform is provided to the centres and the platform coordination, respectively.

**Table S1.** Programming languages, platforms, and libraries.

<b>Programs</b>	<b>Version</b>	<b>Producer</b>	<b>Reference</b>
<b>Python</b>	3.8.6	Python Software Foundation	<a href="https://www.python.org/">https://www.python.org/</a>
jinja2	2.11.0	Pallets	<a href="https://jinja.palletsprojects.com/">https://jinja.palletsprojects.com/</a>
numpy	1.19.4	NumPy	<a href="https://numpy.org/">https://numpy.org/</a>
pandas	1.3.1	NumFOCUS, Inc.	<a href="https://pandas.pydata.org/">https://pandas.pydata.org/</a>
pdfkit	1.0.0	PyPI	<a href="https://pypi.org/project/pdfkit/">https://pypi.org/project/pdfkit/</a>
<b>R</b>	4.0.2	The R Foundation	<a href="https://www.r-project.org/">https://www.r-project.org/</a>
data.table	1.14.0	Matt Dowle, Arun Srinivasan	<a href="https://cran.r-project.org/web/packages/data.table/index.html">https://cran.r-project.org/web/packages/data.table/index.html</a>
dplyr	1.0.5	Hadley Wickham, Romain François, Lionel Henry, Kirill Müller, RStudio	<a href="https://dplyr.tidyverse.org/">https://dplyr.tidyverse.org/</a>
lubridate	1.7.10	Vitalie Spinu, Garrett Golemund, Hadley Wickham	<a href="https://lubridate.tidyverse.org/">https://lubridate.tidyverse.org/</a>
readxl	1.3.1	Hadley Wickham, Jennifer Bryan, RStudio	<a href="https://readxl.tidyverse.org/">https://readxl.tidyverse.org/</a>
readr	2.0.1	Hadley Wickham, Jim Hester, Jennifer Bryan, RStudio	<a href="https://readr.tidyverse.org/">https://readr.tidyverse.org/</a>
<b>RStudio</b>	1.3.1093	posit	<a href="https://posit.co/">https://posit.co/</a>
<b>Django</b>	3.0.10	Django Software Foundation	<a href="https://www.djangoproject.com/">https://www.djangoproject.com/</a>
<b>Nextcloud</b>	21.0.9	Nextcloud GmbH	<a href="https://nextcloud.com/">https://nextcloud.com/</a>
<b>Keycloak</b>	18.0.0	WildFly, a division of Red Hat	<a href="https://www.keycloak.org/">https://www.keycloak.org/</a>

**Table S2:** Recruitment and reimbursement characteristics by cohort and centre.

Centre	First enrolment (Month/Year)	Documented cases (n)	Reimbursed cases (n)	Average reimbursement per case (€)	Fulfilment rate follow up month 3 (%)	Fulfilment rate follow up month 6 (%)	Fulfilment rate follow up month 12 (%)	Fulfilment rate follow up by telephone (%)
<b>High-Resolution Platform</b>								
Centre A	11/2020	164	164	6,797.53	37.1	42.0	26.2	
Centre B	12/2020	34	34	6,170.33	88.0	77.3	33.3	
Centre C	1/2021	29	29	5,299.43	86.4	66.7	41.7	
Centre D	2/2021	102	102	3,876.32	40.9	33.9	0.0	
Centre E	2/2021	38	38	3,626.85	44.0	34.6	5.0	
Centre F	11/2021	10	10	2,867.22	0.0	0.0	0.0	
Centre G	2/2021	30	30	2,827.40	52.0	44.4	50.0	
Centre H	2/2021	11	11	2,787.08	72.7	54.5	25.0	
Centre I	4/2021	25	25	2,480.22	54.5	23.8	0.0	
Centre J	3/2021	4	4	1,901.91	25.0	0.0	0.0	
<b>Population-Based Platform</b>								
Centre A	3/2021	301	301	2,804.74				
Centre B	1/2021	348	348	2,756.18				
Centre C	11/2020	1663	1663	2,658.20				
<b>Cross-Sectoral Platform – academic medical centres (AMC)</b>								
Centre A	1/2021	88	86	3,479.29	84.9		78.6	74.9
Centre B	1/2021	50	49	2,864.11	52.9		33.3	25.7
Centre C	12/2020	84	83	2,799.78	80.3		78.1	26.4
Centre D	1/2021	80	76	2,795.10	75.7		53.8	59.4
Centre E	2/2021	114	110	2,793.60	86.0		0.0	51.7
Centre F	1/2021	45	44	2,778.53	89.5		61.5	43.4
Centre G	1/2021	42	42	2,691.39	70.6		60.0	93.1
Centre H	11/2020	91	90	2,354.12	63.0		19.5	33.4
Centre I	3/2021	61	60	2,323.38	74.1		17.4	41.4



Centre J	12/2021	3	3	2,293.73	100.0	0.0	50.0
Centre K	6/2021	19	13	2,171.67	46.2	0.0	36.4
Centre L	2/2021	69	69	2,102.35	56.5	15.0	41.4
Centre M	7/2021	15	15	2,026.79	77.8	0.0	41.5
Centre N	1/2021	73	72	2,015.81	70.8	29.0	32.2
Centre O	12/2020	82	82	1,721.52	52.1	46.2	26.4
Centre P	4/2021	112	100	1,611.16	30.5	0.0	29.7
Centre Q	5/2021	47	46	1,532.44	57.1	0.0	9.8
Centre R	3/2021	51	51	1,503.03	62.5	0.0	12.6
Centre S	1/2021	60	57	1,500.83	64.0	55.2	3.6
Centre T	2/2021	60	56	1,357.91	38.9	0.0	2.3
Centre U	3/2021	9	9	1,313.39	50.0	0.0	4.8
Centre V	2/2021	54	52	1,271.10	38.3	11.1	12.5
Centre W	2/2021	60	60	1,267.27	61.4	66.7	10.0
Centre X	12/2020	54	54	1,046.92	59.2	24.4	25.3
Centre Y	2/2021	62	60	980.30	37.5	0.0	5.1

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**Cross-Sectoral Platform – non-academic medical centres (non-AMC)**

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Centre A	8/2021	9	9	2,165.96	100.0	0.0	90.9
Centre B	10/2021	5	5	2,034.76	100.0	100.0	100.0
Centre C	8/2021	2	2	1,621.10	100.0	0.0	100.0
Centre D	8/2021	18	17	1,542.94	100.0	0.0	100.0
Centre E	3/2021	6	5	1,534.00	100.0	0.0	40.0
Centre F	9/2021	6	5	1,366.25	100.0	0.0	100.0
Centre G	8/2021	17	16	1,338.55	72.7	0.0	100.0
Centre H	12/2021	1	1	1,261.97	0.0	0.0	0.0
Centre I	10/2021	14	8	1,234.53	62.5	0.0	62.5
Centre J	11/2021	5	5	1,200.46	100.0	0.0	80.0
Centre K	4/2021	5	5	1,170.39	66.7	0.0	14.3
Centre L	7/2021	22	22	1,029.63	89.5	0.0	66.7
Centre M	10/2021	14	13	858.90	33.3	0.0	23.1
Centre N	2/2021	50	48	736.69	34.9	16.7	11.3
Centre O	11/2021	1	1	712.82	100.0	0.0	0.0

Centre P	12/2021	4	4	685.66	0.0	0.0	75.0
Centre Q	12/2021	2	2	666.75	0.0	0.0	100.0
Centre R	10/2021	3	3	599.77	100.0	0.0	50.0
Centre S	8/2021	25	23	529.81	61.9	0.0	2.8

Fulfilment rates are calculated without deceased patients. If the recruitment launch of a centre was comparably late, the conduction of a certain follow-up might not (yet) have been feasible.