FACULTY OF MEDICINE AND HEALTH SCIENCES

The Real Deal Behind the Artificial Appeal

Inferential Utility of Tabular Synthetic Data

Decruyenaere A*, Dehaene H*, Rabaey P, et al.

poster #406

UAI conference, July 18th, 2024

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SYNDARA

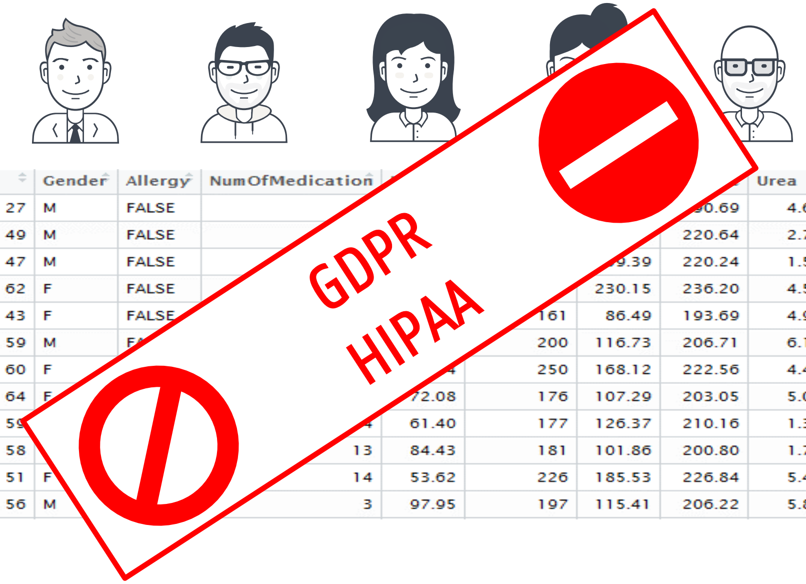
Naive statistical inference from synthetic data cannot be trusted

Original data

Age	Gender	Allergy	NumOfMedication	HDL	Colesterol	LDL	Glucose	Urea	ICD
27	M	FALSE	13	83.61	154	80.71	190.69	4.60	A18
49	M	FALSE	5	68.10	212	160.85	220.64	2.70	A18
47	M	FALSE	1	88.38	228	159.39	220.24	1.50	A02
62	F	FALSE	1	62.77	286	230.15	236.20	4.50	A18
43	F	FALSE	4	83.44	161	86.49	193.69	4.90	A18
59	M	FALSE	1	95.50	200	116.73	206.71	6.15	A18
60	F	FALSE	14	90.84	250	168.12	222.56	4.44	A18
64	F	FALSE	6	72.08	176	107.29	203.05	5.08	A18
59	M	FALSE	4	61.40	177	126.37	210.16	1.37	A02
58	M	FALSE	13	84.43	181	101.86	200.80	1.72	A04
51	F	TRUE	14	53.62	226	185.53	226.84	5.43	A18
56	M	FALSE	3	97.95	197	115.41	206.22	5.81	A18

Naive statistical inference from synthetic data cannot be trusted

Original data



Age	Gender	Allergy	NumOfMedication	[illegible]	[illegible]	[illegible]	[illegible]	Urea	ICD
27	M	FALSE		[illegible]	[illegible]	[illegible]	[illegible]	4.60	A18
49	M	FALSE		[illegible]	[illegible]	[illegible]	220.64	2.70	A18
47	M	FALSE		[illegible]	[illegible]	[illegible]	220.24	1.50	A02
62	F	FALSE	[illegible]	[illegible]	[illegible]	230.15	236.20	4.50	A18
43	F	FALSE	[illegible]	[illegible]	161	86.49	193.69	4.90	A18
59	M	[illegible]	[illegible]	[illegible]	200	116.73	206.71	6.15	A18
60	F	[illegible]	[illegible]	[illegible]	250	168.12	222.56	4.44	A18
64	F	[illegible]	[illegible]	72.08	176	107.29	203.05	5.08	A18
[illegible]	[illegible]	[illegible]	[illegible]	61.40	177	126.37	210.16	1.37	A02
58	[illegible]	[illegible]	13	84.43	181	101.86	200.80	1.72	A04
51	F	[illegible]	14	53.62	226	185.53	226.84	5.43	A18
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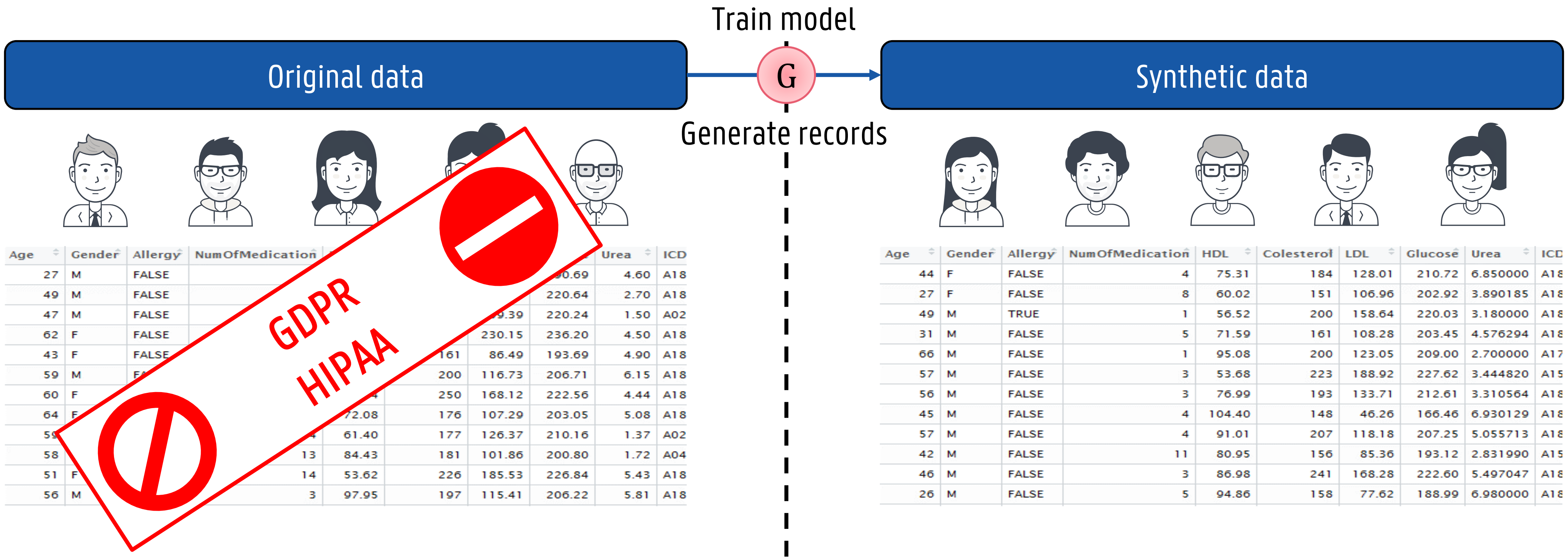

Age	Gender	Allergy	NumOfMedication	[illegible]	[illegible]	[illegible]	[illegible]	Urea	ICD
27	M	FALSE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.60	A18
49	M	FALSE	[illegible]	[illegible]	[illegible]	[illegible]	220.64	2.70	A18
47	M	FALSE	[illegible]	[illegible]	[illegible]	[illegible]	220.24	1.50	A02
62	F	FALSE	[illegible]	[illegible]	[illegible]	230.15	236.20	4.50	A18
43	F	FALSE	[illegible]	[illegible]	161	86.49	193.69	4.90	A18
59	M	[illegible]	[illegible]	[illegible]	200	116.73	206.71	6.15	A18
60	F	[illegible]	[illegible]	[illegible]	250	168.12	222.56	4.44	A18
64	F	[illegible]	[illegible]	72.08	176	107.29	203.05	5.08	A18
59	[illegible]	[illegible]	4	61.40	177	126.37	210.16	1.37	A02
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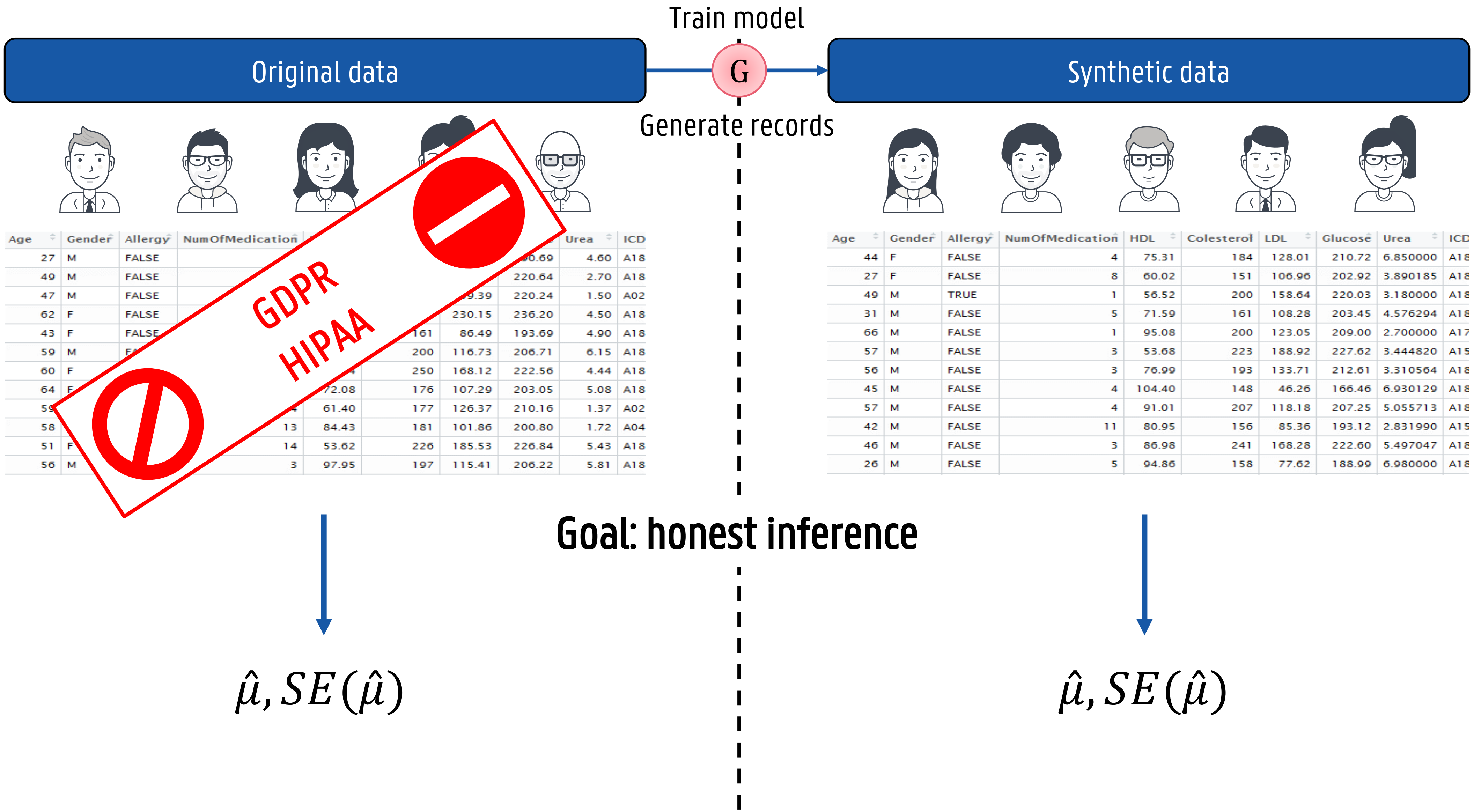
Age	Gender	Allergy	NumOfMedication	HDL	Colesterol	LDL	Glucose	Urea	ICD
44	F	FALSE	4	75.31	184	128.01	210.72	6.850000	A18
27	F	FALSE	8	60.02	151	106.96	202.92	3.890185	A18
49	M	TRUE	1	56.52	200	158.64	220.03	3.180000	A18
31	M	FALSE	5	71.59	161	108.28	203.45	4.576294	A18
66	M	FALSE	1	95.08	200	123.05	209.00	2.700000	A17
57	M	FALSE	3	53.68	223	188.92	227.62	3.444820	A15
56	M	FALSE	3	76.99	193	133.71	212.61	3.310564	A18
45	M	FALSE	4	104.40	148	46.26	166.46	6.930129	A18
57	M	FALSE	4	91.01	207	118.18	207.25	5.055713	A18
42	M	FALSE	11	80.95	156	85.36	193.12	2.831990	A15
46	M	FALSE	3	86.98	241	168.28	222.60	5.497047	A18
26	M	FALSE	5	94.86	158	77.62	188.99	6.980000	A18

Naive statistical inference from synthetic data cannot be trusted



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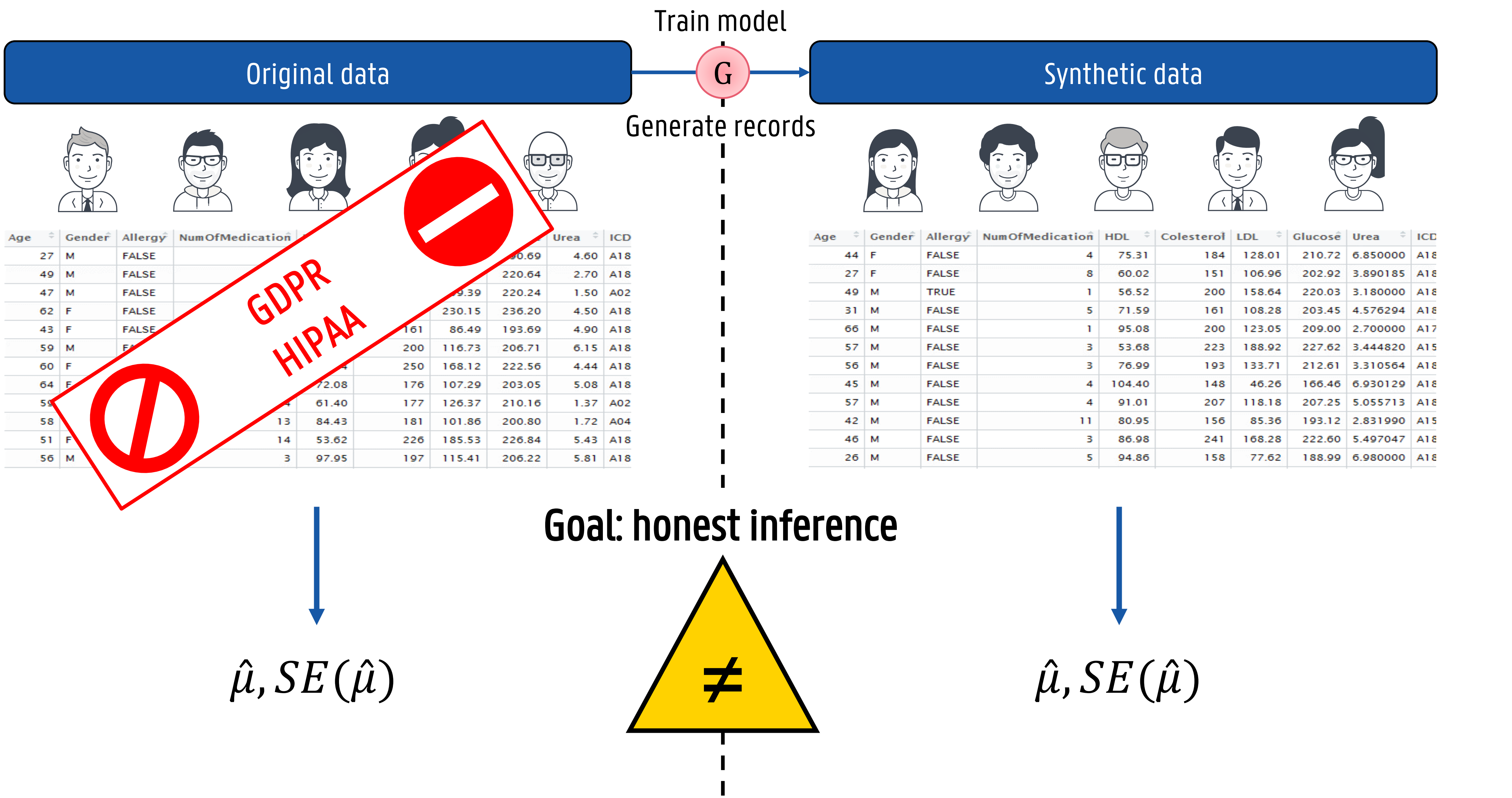

Age	Gender	Allergy	NumOfMedication					Urea	ICD
27	M	FALSE						4.60	A18
49	M	FALSE					220.64	2.70	A18
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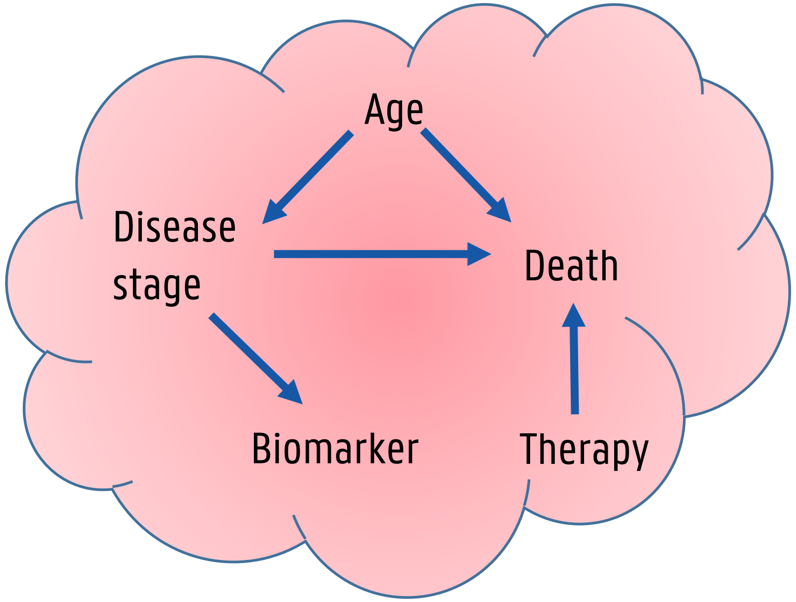
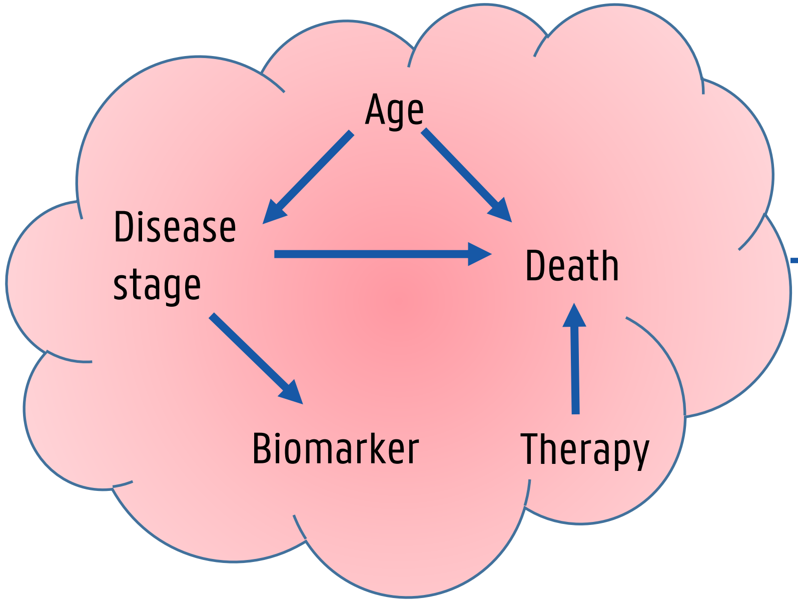
26	M	FALSE	5	94.86	158	77.62	188.99	6.980000	A18

We investigated the behaviour of estimators in synthetic data



We investigated the behaviour of estimators in synthetic data

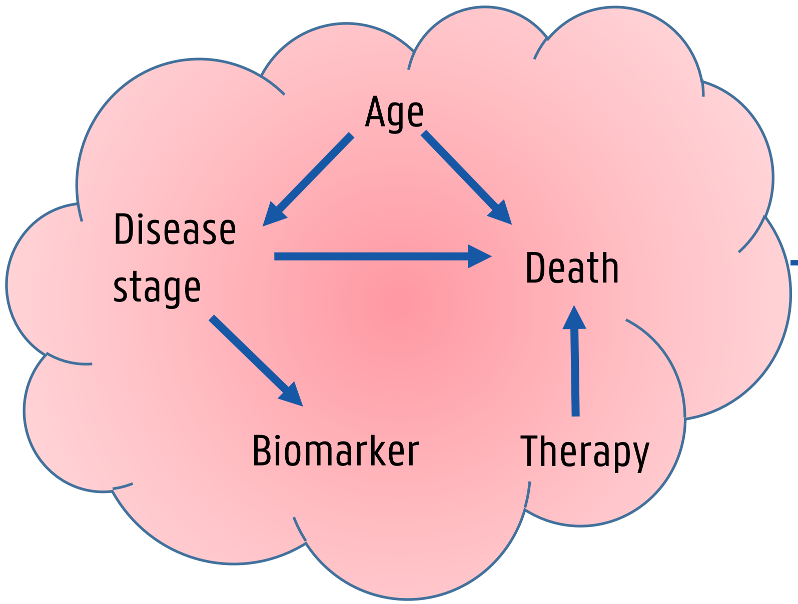


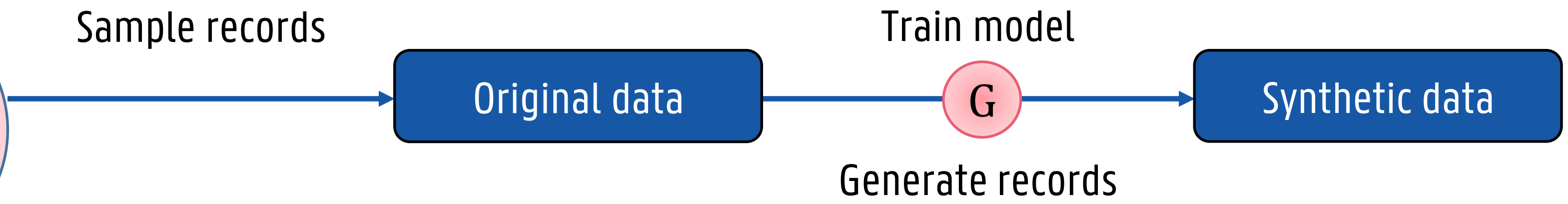
Sample records

Original data

27	M	FALSE	13	83.61
49	M	FALSE	5	68.10
47	M	FALSE	1	88.38
62	F	FALSE	1	62.77
43	F	FALSE	4	83.44
59	M	FALSE	1	95.50
60	F	FALSE	14	90.84
64	F	FALSE	6	72.08
59	M	FALSE	4	61.40
58	M	FALSE	13	84.43
51	F	TRUE	14	53.62
56	M	FALSE	3	97.95

We investigated the behaviour of estimators in synthetic data





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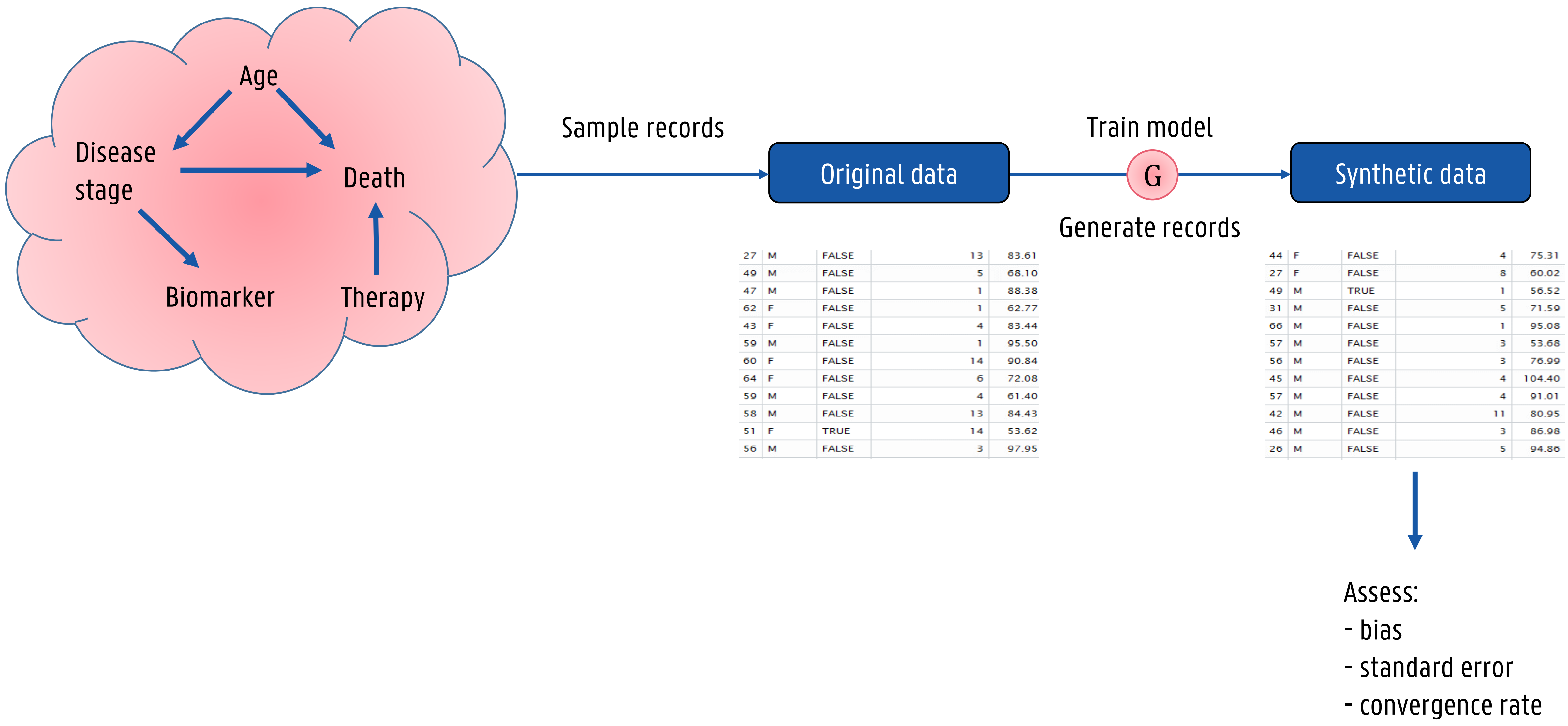
31	M	FALSE	5	71.59
66	M	FALSE	1	95.08
57	M	FALSE	3	53.68
56	M	FALSE	3	76.99
45	M	FALSE	4	104.40
57	M	FALSE	4	91.01
42	M	FALSE	11	80.95
46	M	FALSE	3	86.98
26	M	FALSE	5	94.86

We investigated the behaviour of estimators in synthetic data



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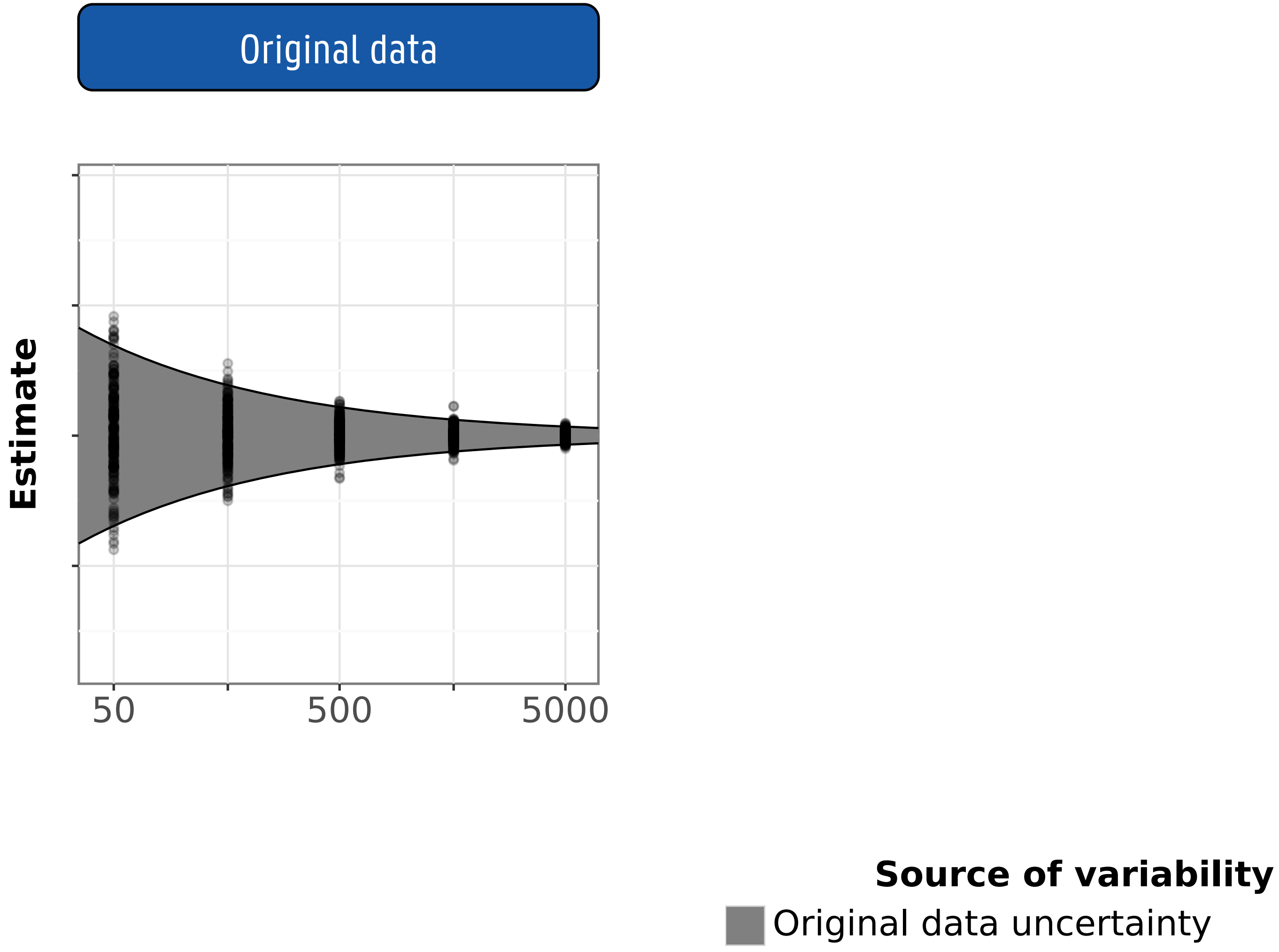
56	M	FALSE	3	76.99
45	M	FALSE	4	104.40
57	M	FALSE	4	91.01
42	M	FALSE	11	80.95
46	M	FALSE	3	86.98
26	M	FALSE	5	94.86

Original standard errors are insufficient for synthetic data



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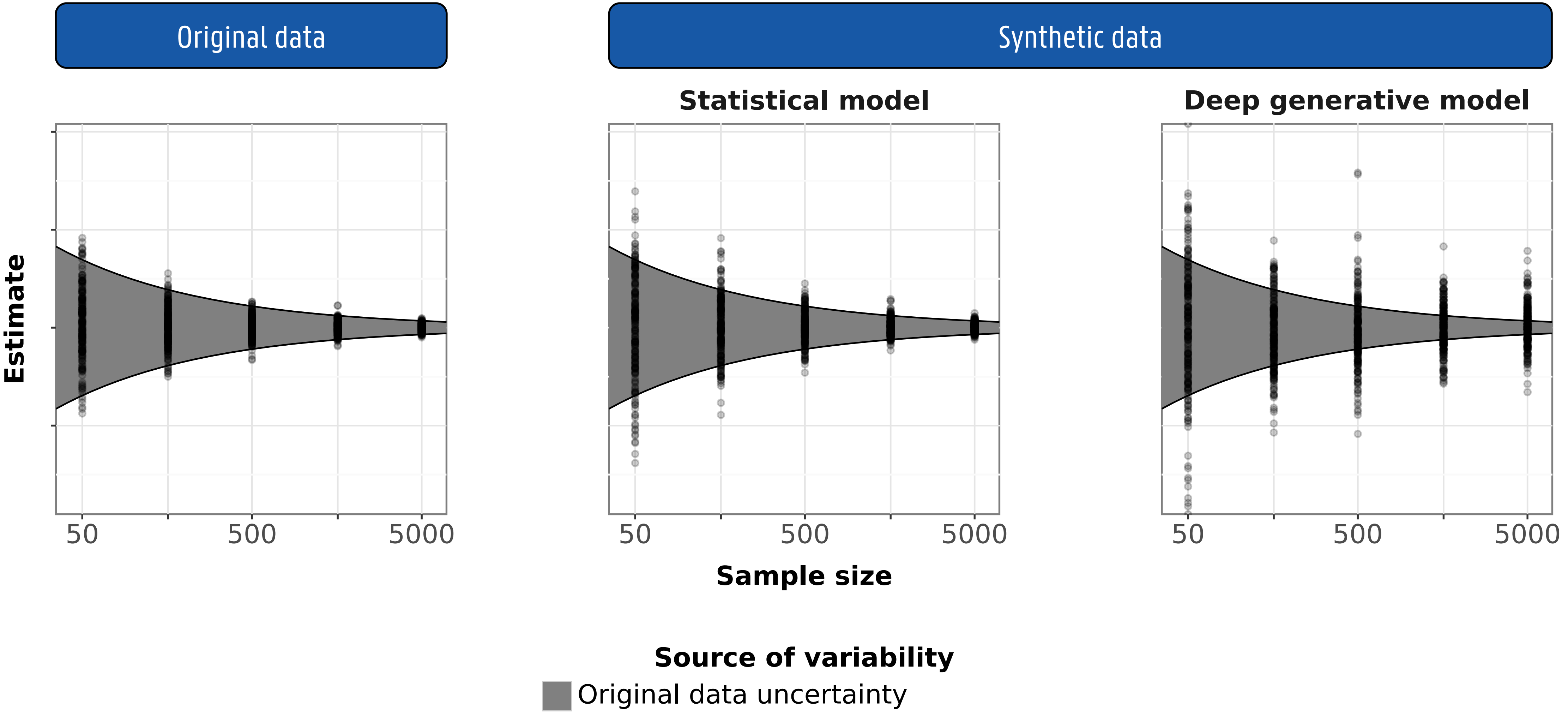
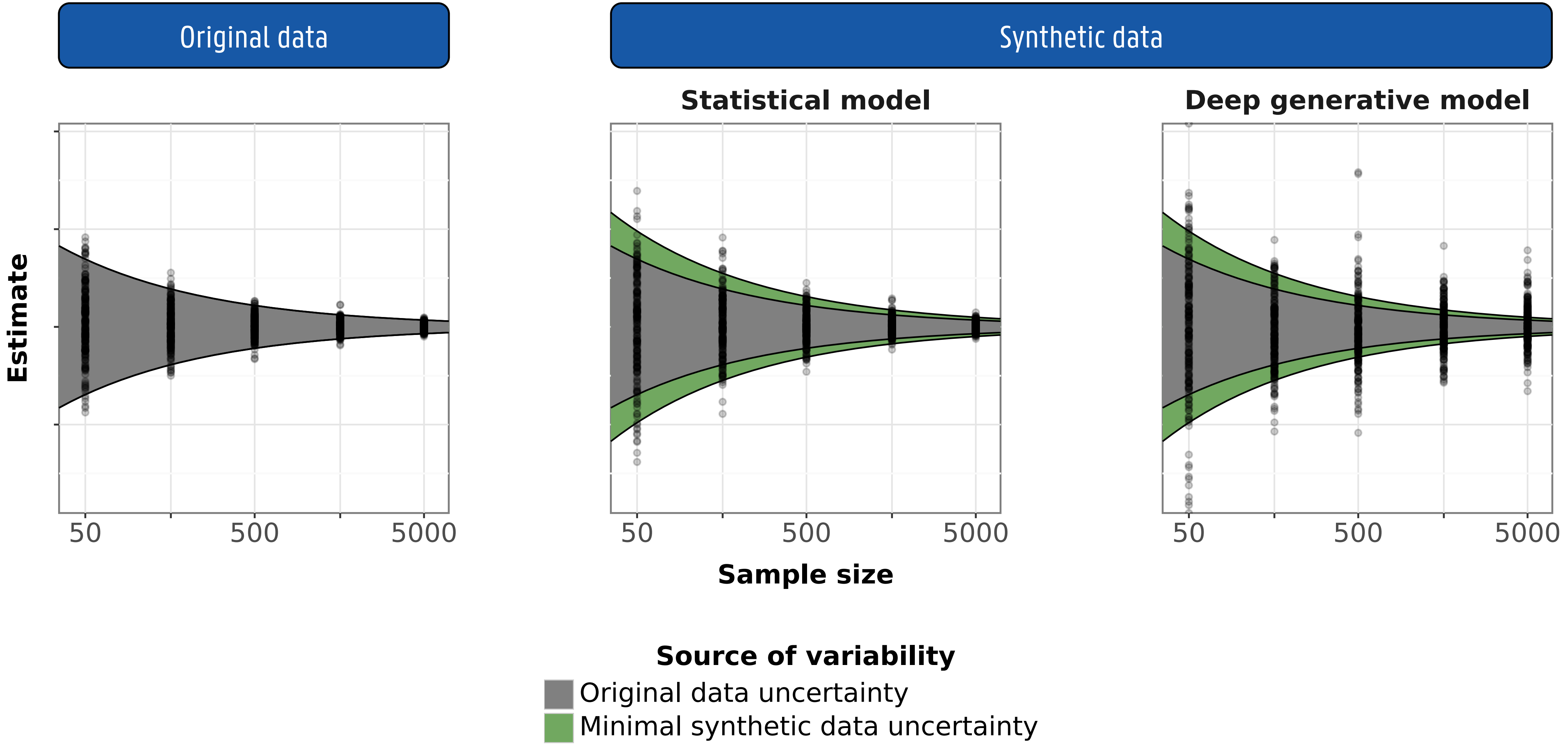
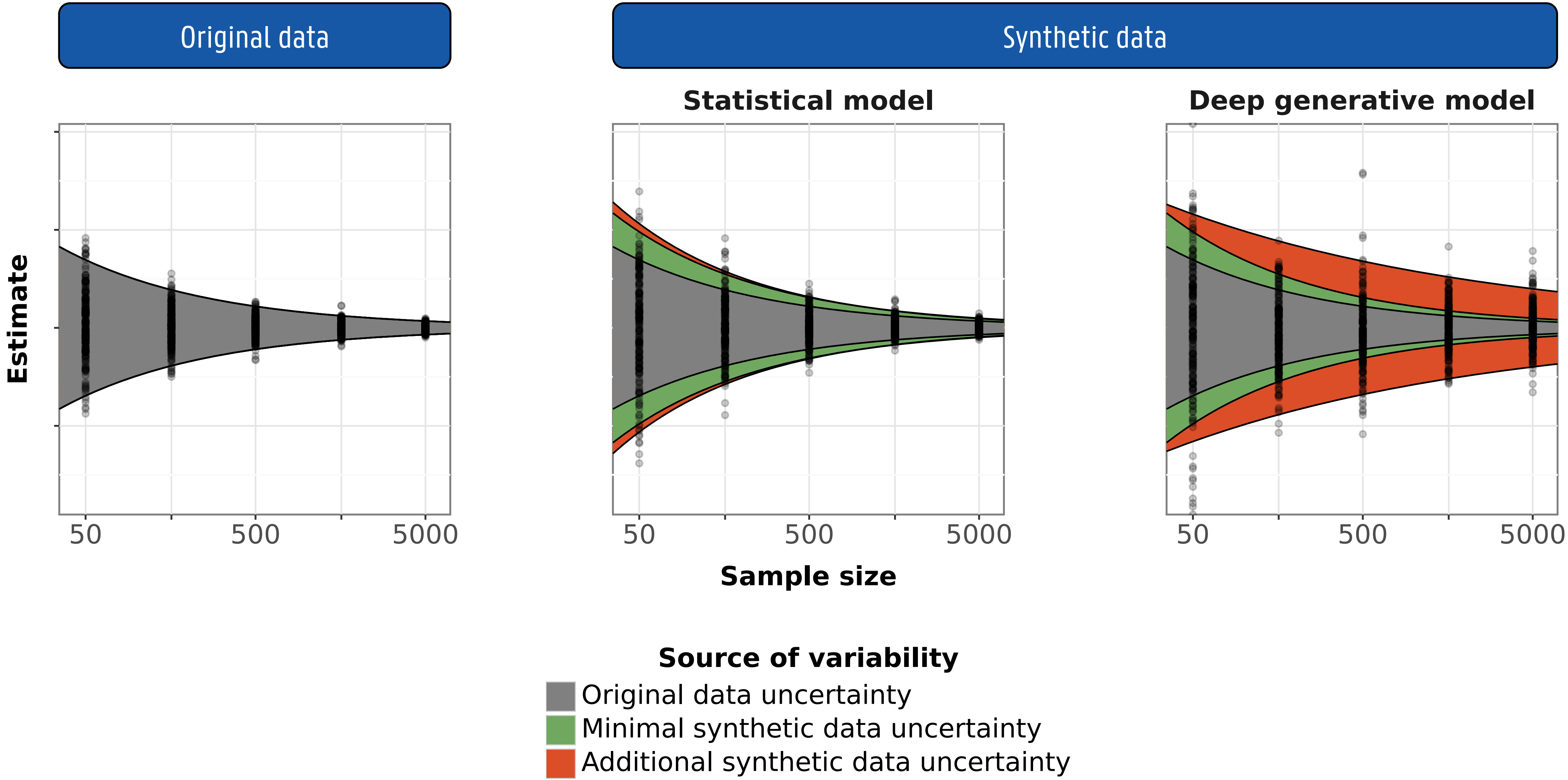


Corrected standard errors are sufficient only for statistical models



Corrected standard errors are insufficient for deep generative models



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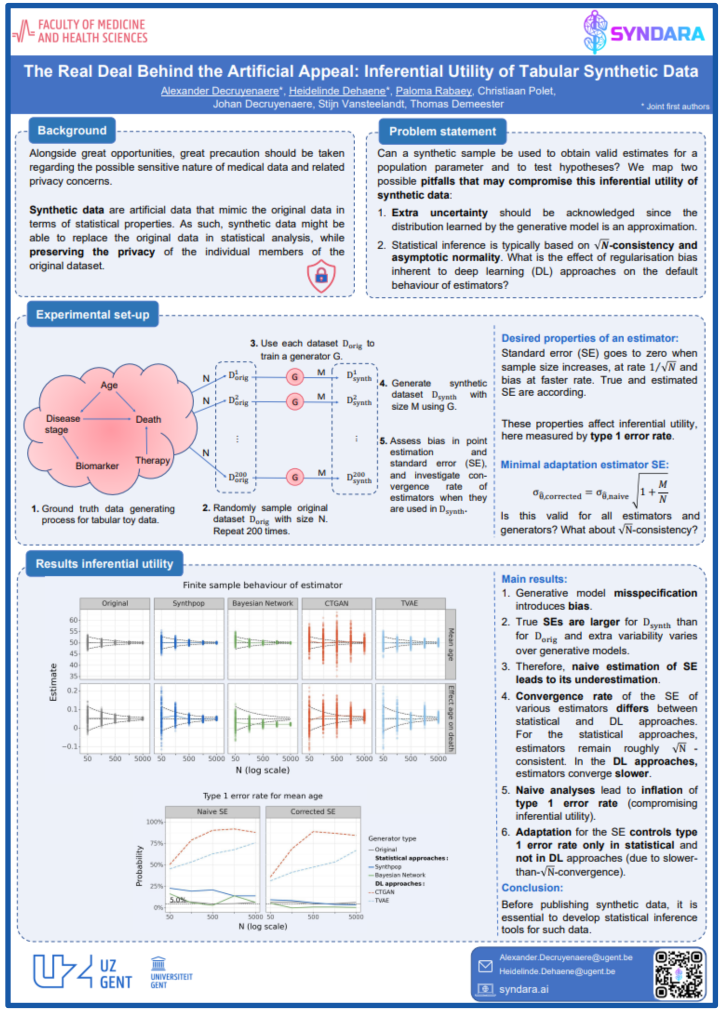

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