KAN FRITEKST I JOURNALER BRUGES TIL NOGET FORNUFTIGT?

SEPTEMBER 2024

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DISCLOSURE

- Medstifter af Aiomic, et dansk healthtechfirma der arbejder med kirurgisk kvalitetsoptimering.

DEN KLINISKE UDFORDRING MED UDGANGSPUNKT I KIRURGI

Stigende antal behandlinger uden beviselig effekt

$31b

Omkostninger for det amerikanske sundhedsvæsen til at dække komplikationer efter kirurgi

~50%

Af behandlinger er understøttet af evidens

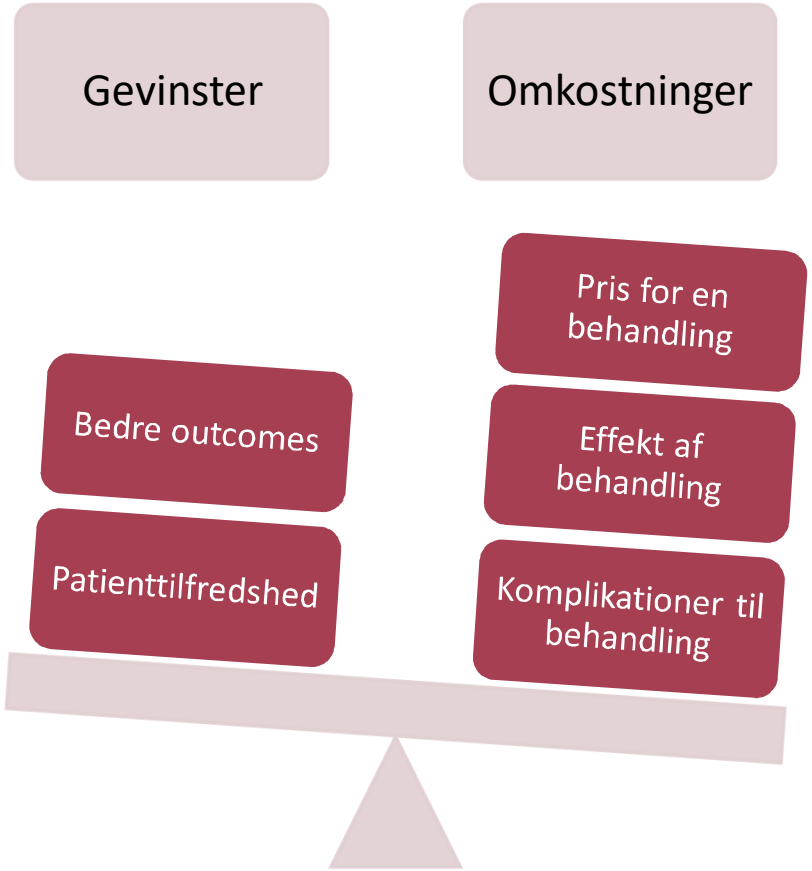
+20%

Procent af BNP der forventes brugt på sundhed I 2031 I vesten

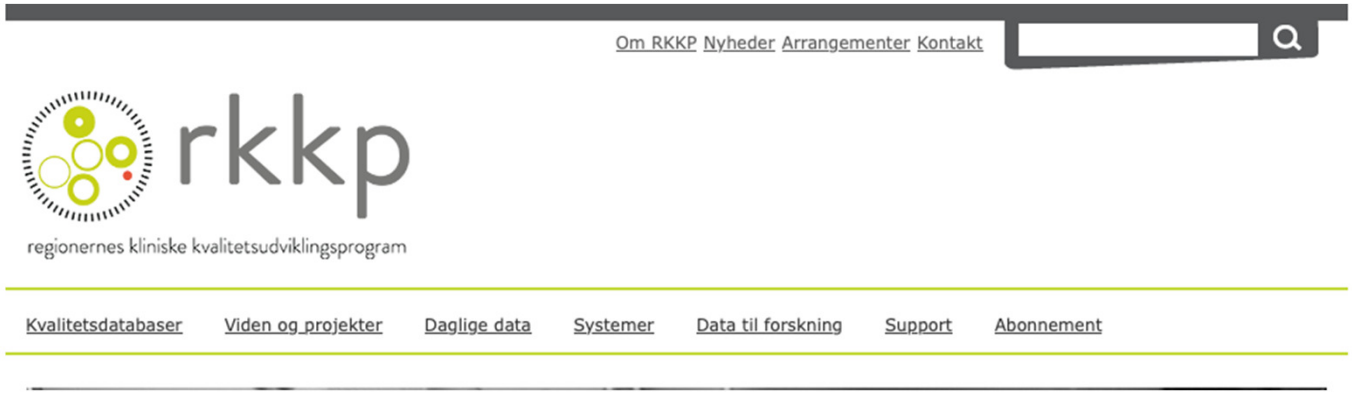
~25%

Af behandlinger med ukendt eller direkte skadelig effekt

BEHOV FOR AT AFVEJE FORDELE OG ULEMPER



KIRURGI – HVORDAN GØR VI I DAG?



HVAD KAN VI MÅLE MED DE DANSKE REGISTRE FOR KIRURGISKE PROCEDURER?

- Indlæggelsestid
- Mortalitet

- Genindlæggelser?
- Komplikationer?
- Patient reported outcomes?

- I Danmark peger pilen mod stigende automatisering af datahøst

HVAD GØR MAN I UDLANDET?

vizient

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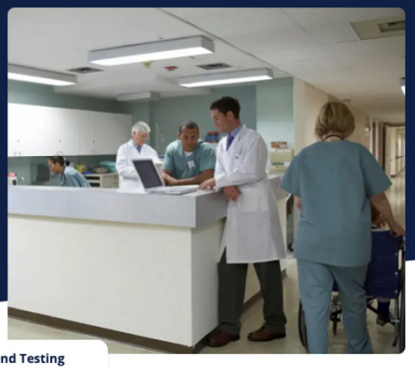
DATA AND REGISTRIES

ACS National Surgical Quality Improvement Program



NSQIP Participant Portal
For managing hospital info and registry access

ACS NSQIP Registry
Enter clinical data and access NSQIP data reports

SCR Training and Testing
Become your hospital's Surgical Clinical Reviewer

FOKUS PÅ KOMPLIKATIONER EFTER KIRURGI

HVOR GODE ER VI TIL AT REGISTRERE KOMPLIKATIONER?

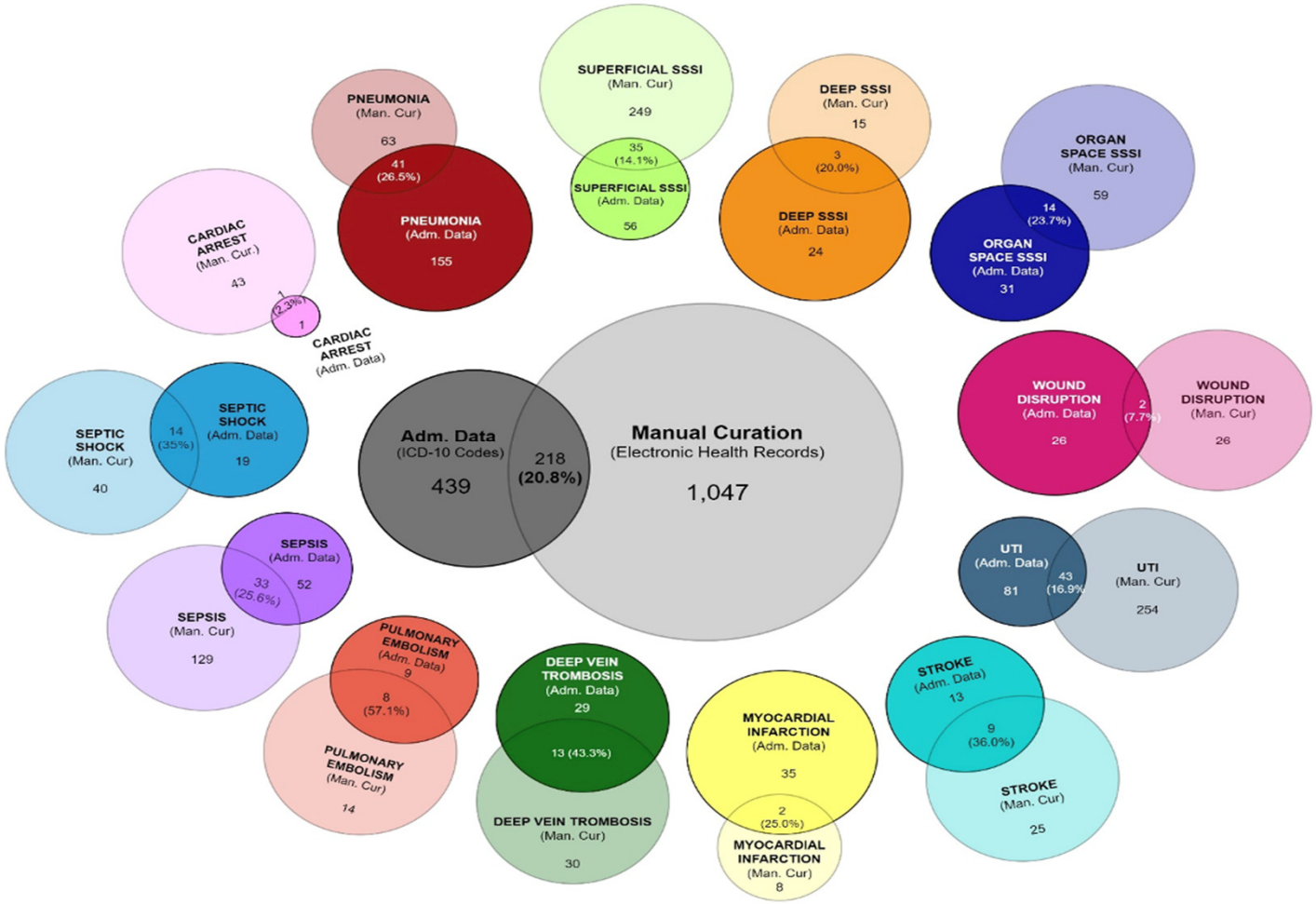
ASSESSING THE ACCURACY GAP IN POSTOPERATIVE COMPLICATIONS SURVEILLANCE: ADMINISTRATIVE DATA VERSUS MANUAL CURATION – CLINICAL AND ECONOMIC IMPLICATIONS

Emilie Even Dencker MD[1,2], Alexander Bonde MD PhD[1,2], Stephan Sloth Lorenzen Msc PhD[3], Anders Troelsen MD PhD DMsc[5,5], Martin Sillesen MD PhD[1,2,5].

- 11.827 operationsforløb fra RegionH og RegionSj manuelt gennemgået
- 86.610 journalnotater gennemgået

- Komplikationer manuelt registreret og sammenlignet med hvad der er registreret med diagnosekoder

REGISTRERING AF KOMPLIKATIONER



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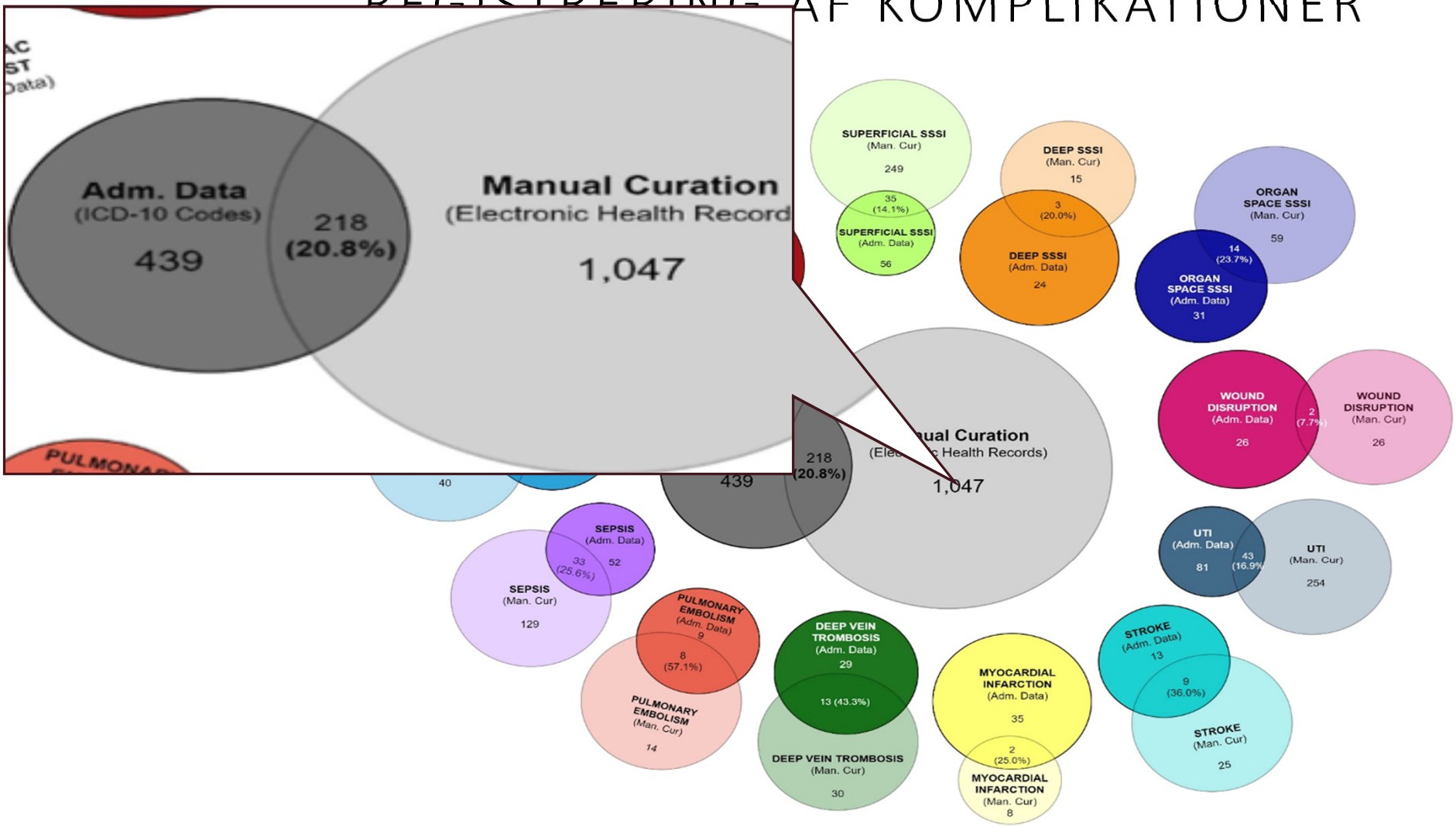

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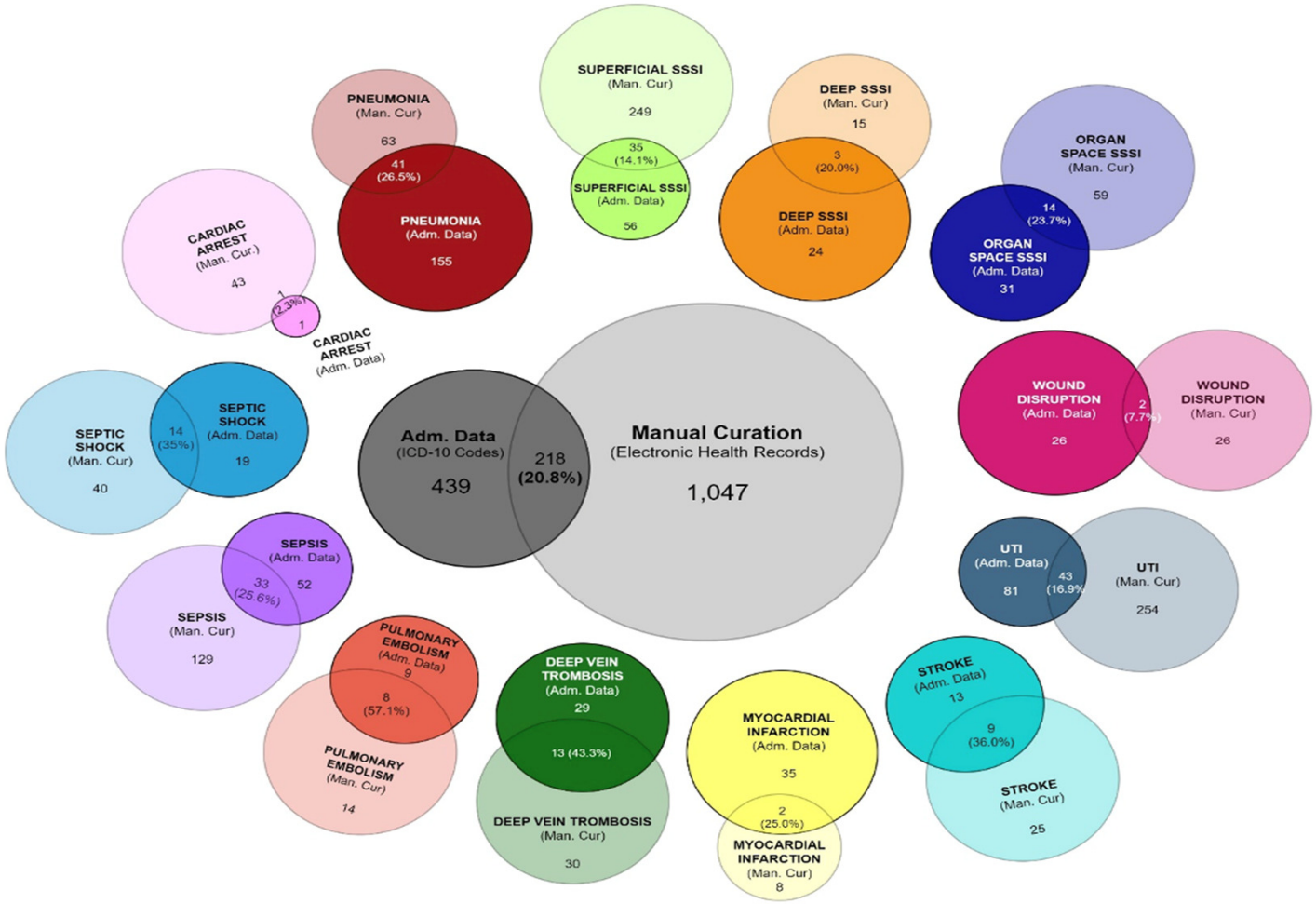

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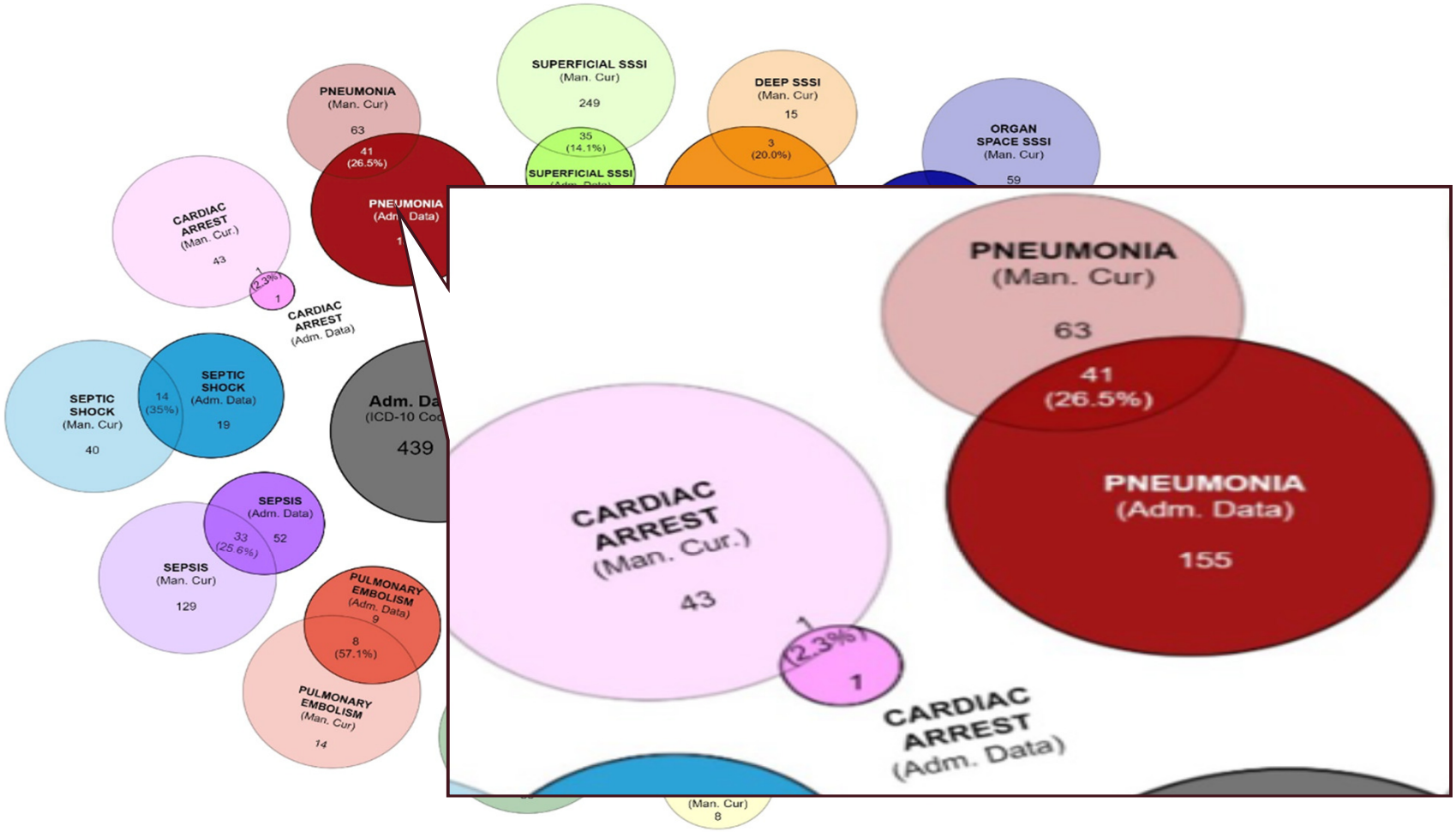

HVIS KOMPLIKATIONSKODNING VAR EN MEDICINSK TEST

Postoperative complication:	Sensitivity	Specificity	PPV	NPV
Superficial surgical site infection:	**0.1406**	0.9982	0.6250	0.9818
Deep surgical site infection:	**0.2000**	0.9982	0.1250	0.9990
Organ space surgical site infection:	**0.2373**	0.9986	0.4516	0.9962
Wound disruption:	**0.0769**	0.9980	0.0769	0.9980
Pneumonia:	**0.2645**	0.9981	0.6508	0.9903
Pulmonary embolism:	**0.5714**	0.9999	0.8889	0.9995
Urinary tract infection:	**0.1693**	0.9967	0.5309	0.9820
Stroke:	**0.3600**	0.9997	0.6923	0.9986
Cardiac arrest:	**0.0233**	1	1	0.9964
Myocardial infarction:	**0.2500**	0.9972	0.0571	0.9995
Deep vein thrombosis:	**0.4333**	0.9986	0.4483	0.9986
Sepsis:	**0.2558**	0.9984	0. 6346	0.9918
Septic Shock:	**0.3500**	0.9996	0.7368	0.9978
Total:	**0.2058**	0.9803	0.4967	0.9291

STATE OF THE ART I DANSK KIRURGISK KVALITETSSIKRING

BETYDER KOMPLIKATONER NOGET?

- Patienter med en komplikationer efter kirurgi har:
  - 6,6 gange højere rate af genindlæggelser
  - 6 yderligere indlæggelsesdage
  - 7,7 gange flere reoperationer

INDLÆGGELSEDAGE ASSOCIERET MED KOMPLIKATIONER

Postoperative Complication:	Admission days	ICU days
Superficial surgical site infection:	4.04	0.296
Deep surgical site infection:	4.57	-0.511
Organ/Space surgical site infection:	11.2	0.812
Wound disruption:	7.01	1.64
Pneumonia:	9.57	0.972
Pulmonary Embolism:	9.80	-0.795
Urinary tract infection:	5.38	0.306
Stroke:	10.8	2.66
Cardiac arrest:	2.16	0.990
Myocardial infarction:	1.46	1.67
Deep vein thrombosis:	3.22	1.80
Sepsis:	9.24	1.68
Septic Shock:	7.51	5.38

OG DERES OMKOSTNINGER OVER EN ENKELT MÅNED

Postoperative complication	Number of PCs in dataset (manual cur.)	Associated additional admission days	Sum of additional days / PC	Per diem rate	Total costs
Superficial surgical site infection:	249	4.04	1,006	€310.43	**€312,292.58**
Deep surgical site infection:	15	4.57	69	€310.43	**€21,419.67**
Organ space surgical site infection:	59	11.2	661	€310.43	**€205,194.23**
Wound disruption:	26	7.01	182	€310.43	**€56,498.26**
Pneumonia:	155	9.57	1483	€310.43	**€460,367.69**
Pulmonary embolism:	14	9.80	137	€310.43	**€42,528.91**
Urinary tract infection:	254	5.38	1367	€310.43	**€424,357.81**
Stroke:	25	10.8	270	€310.43	**€83,816.10**
Cardiac arrest:	43	2.16	93	€310.43	**€28,869.99**
Myocardial infarction:	8	1.46*	NA	NA	**NA**
Deep vein thrombosis:	30	3.22	97	€310.43	**€30,111.71**
Sepsis:	129	9.24	1,192	€310.43	**€370,032.56**
Septic Shock:	40	7.51	300	€310.43	**€93,253.17**
Total:	**1,047**	**84.5**	**6,857**	**NA**	**€2,128,742.68**

KAN VI BRUGE AI OG FRITEKST TIL NOGET?

FORSKNINGSPROJEKTER

OXFORD

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Original Article

Assessing the utility of natural language processing for detecting postoperative complications from free medical text

Emilie Even Dencker[1,2], Alexander Bonde[1,2,3], Anders Troelsen[4,5] and Martin Sillesen[1,]

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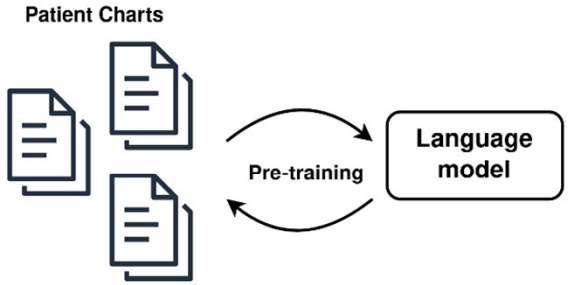
Assessing the utility of deep neural networks in detecting superficial surgical site infections from free text electronic health record data

Alexander Bonde[1,2], Stephan Lorenzen[1], Gustav Brixen[2], Anders Troelsen[3,4] and Martin Sillesen[2,4,5*†]

TRÆNING AF SPROGMODELLER TIL AT FORSTÅ MEDICINSK TEKST

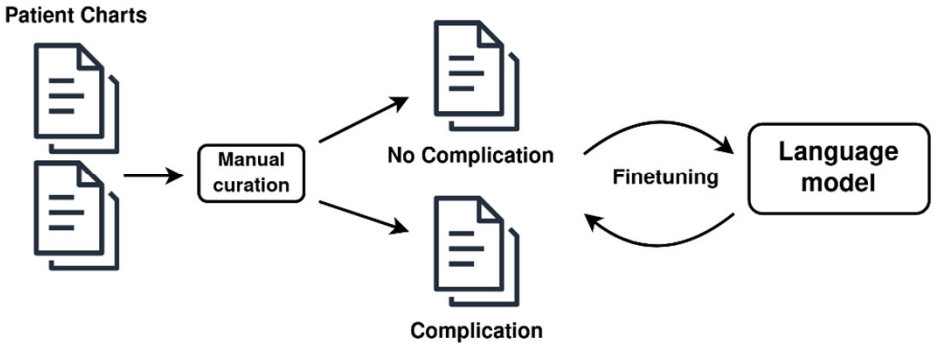
Step 1

The language model is pretrained on a large number of unlabelled free text patient charts.



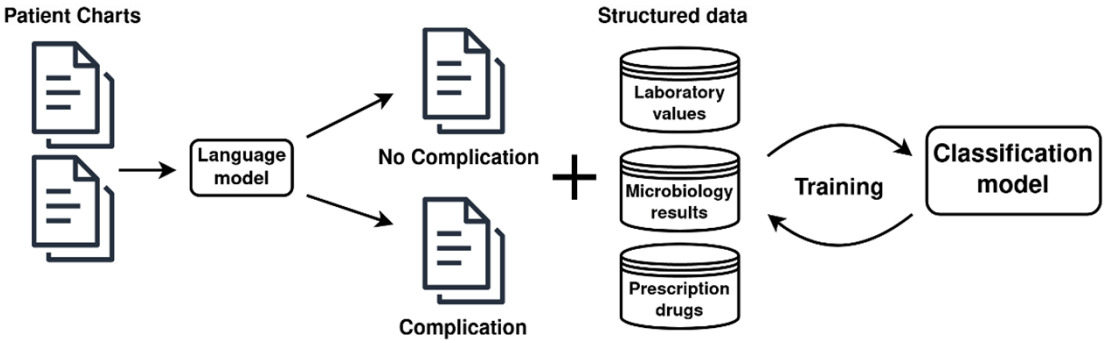
Step 2

The language model is finetuned on a smaller number of manually curated free text patient charts.



Step 3

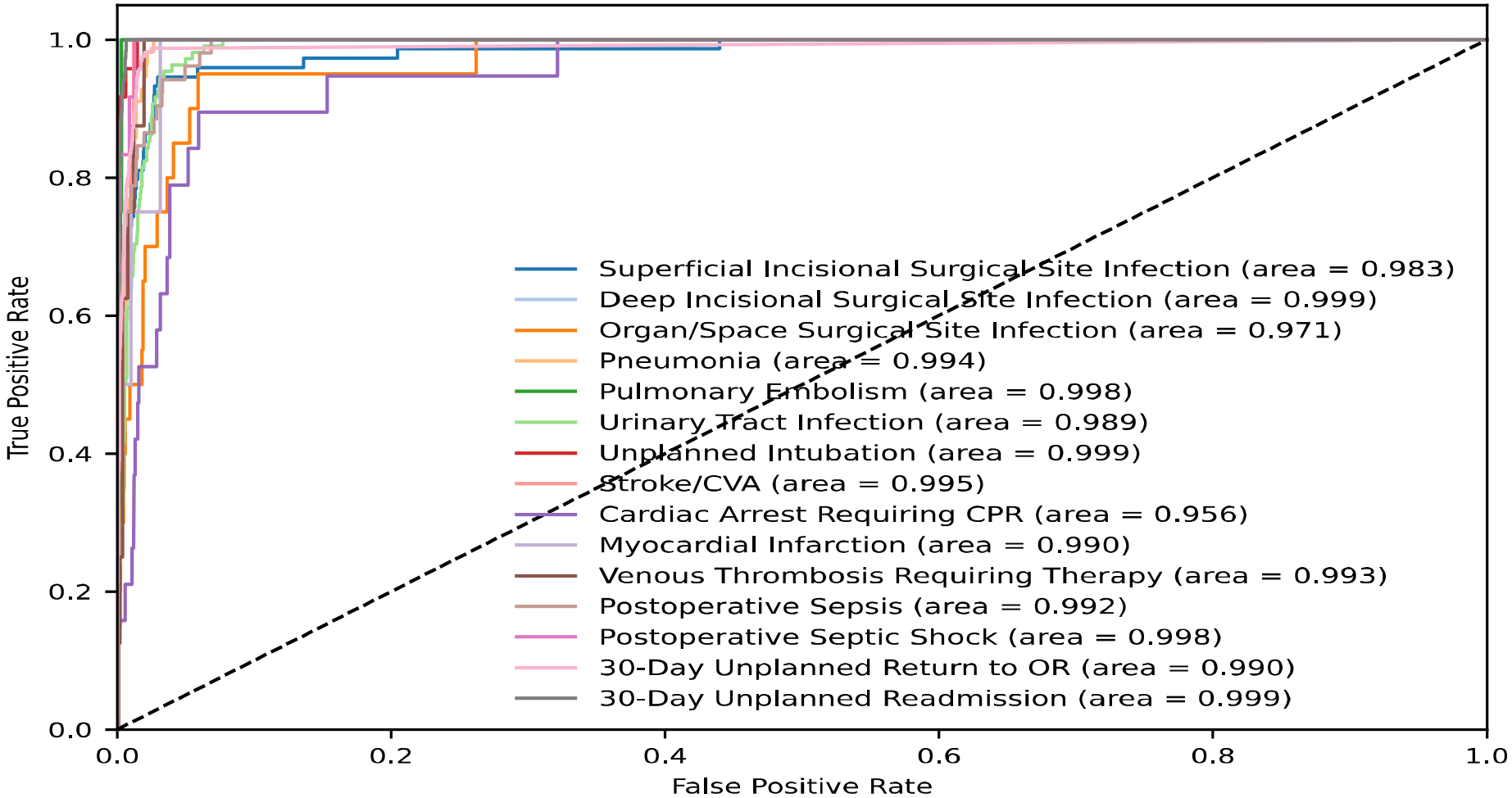
Structured health data is added to obtain the final complications classification model



From data to outcomes

The development steps for the full data pipeline used in this project to train models for detecting outcomes (complications after surgeries) from free medical text

NATURAL LANGUAGE PROCESSING FANGER KOMPLIKATIONER PÅ DANSKE DATA



HUMAN IN THE LOOP ER NØDVENDIGT

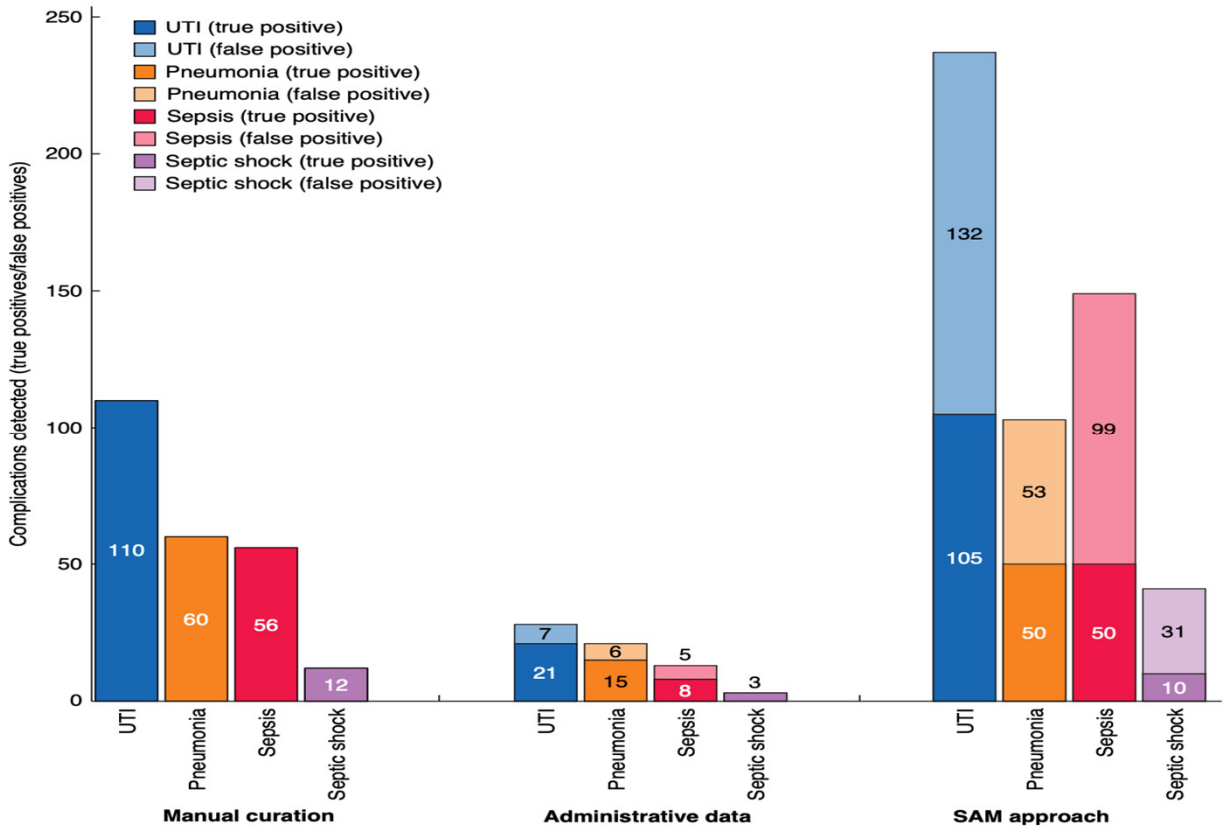


Fig. 2 Comparative bar graphs of number of postoperative complication cases identified by manual curation, administrative data, and the stand-alone model approach for the test data set

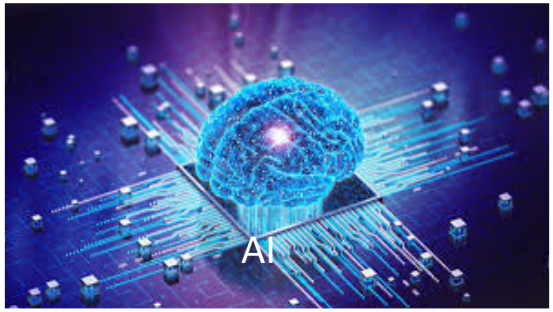
Performance of the HITL approach was similar to manual curation. For each PC the numbers of both true positives and false positives are shown. UTI, urinary tract infection; SAM, stand-alone model.

HVOR MANGE JOURNALER SKAL MANUELT GENNEMGÅES?

Table 3 Performance metrics for administrative data, the stand-alone model (SAM) approach, and the human-in-the-loop approach (HITL) (where all cases with model-determined probability of the given complication existing in the chart note exceeding an F2 score optimized threshold are forwarded to human extraction)

	ROCAUC†	Sensitivity	Specificity	PPV	NPV	Threshold*	Percentage needing manual review
Administrative data (ICD-10)							
UTI	0.595	0.1909	0.9981	0.7500	0.9764	NA	NA
Pneumonia	0.624	0.2500	0.9984	0.7143	0.9881	NA	NA
Sepsis	0.571	0.1429	0.9987	0.6154	0.9873	NA	NA
Septic shock	0.625	0.2500	1.0000	1.0000	0.9976	NA	NA
SAM approach							
UTI	0.989†	0.9545	0.9643	0.4430	0.9986	0.0221	NA
Pneumonia	0.993†	0.8333	0.9858	0.4854	0.9973	0.0770	NA
Sepsis	0.992†	0.8929	0.9736	0.3356	0.9984	0.0148	NA
Septic shock	0.998†	0.8333	0.9918	0.2439	0.9995	0.0104	NA
HITL approach*							
UTI	0.989†	0.9545	1.0000	1.0000	0.9986	0.0221	6.23
Pneumonia	0.993†	0.8333	1.0000	1.0000	0.9973	0.0770	2.71
Sepsis	0.992†	0.8929	1.0000	1.0000	0.9984	0.0148	3.92
Septic shock	0.998†	0.8333	1.0000	1.0000	0.9995	0.0104	1.08

MULIGT FREMTIDIGT SETUP



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Assessing the utility of deep neural networks in predicting postoperative surgical complications: a retrospective study

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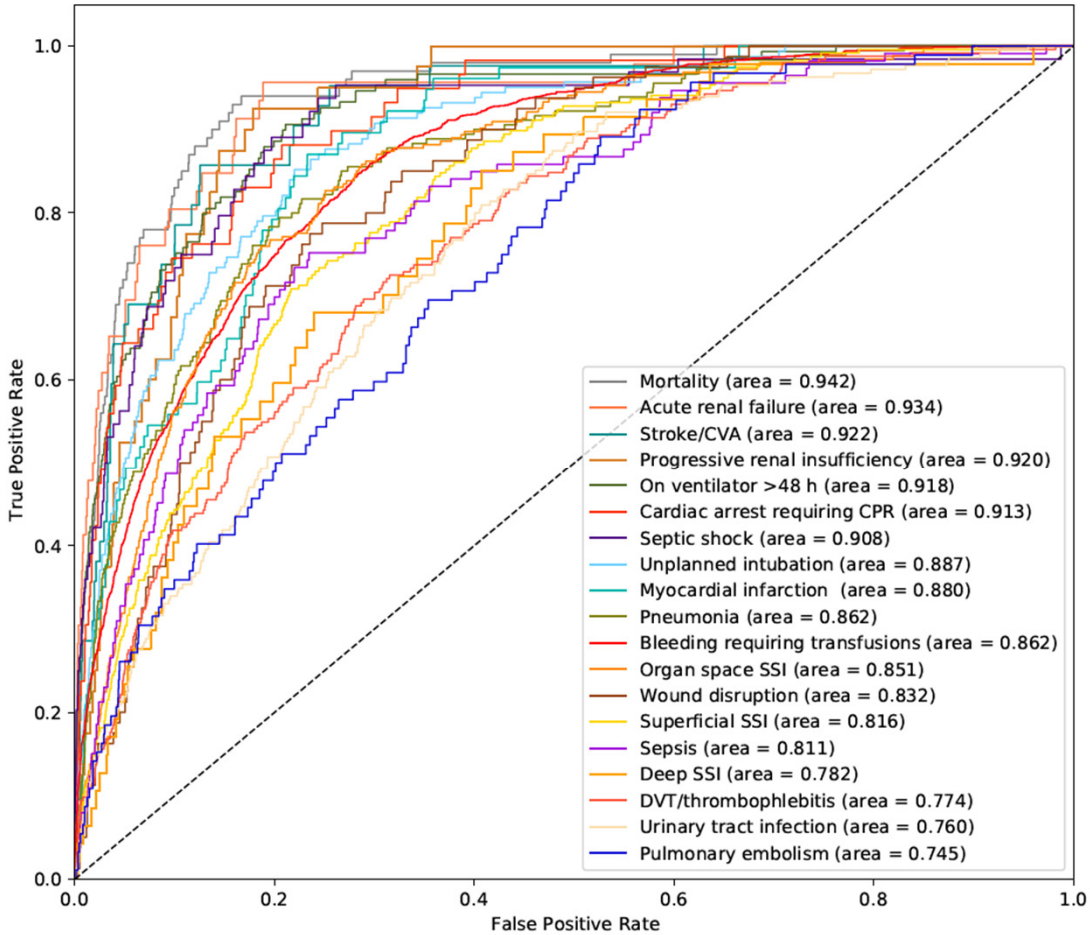
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