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Evaluating the predictive performance and transferability of machine learning-based prediction models using national liver transplant data registries

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	Overall (N=139)
1a. Would you consider offering an organ transplant to a patient with a previous history of immunotherapy treatment for cancer?	
N-Missing	48
Maybe/Don't know	21 (23%)
No	12 (13%)
Yes	58 (64%)
2a. Are you aware of any transplant recipients at your institution that were denied listing for transplantation based on prior immunotherapy exposure?	
N-Missing	48
Don't recall	9 (10%)
No	73 (80%)
Yes	9 (10%)
3a. Are you aware of any transplant recipient in your institution that received immunotherapy for cancer before an organ transplant?	
N-Missing	48
Don't recall	7 (8%)
No	54 (59%)
Yes	30 (33%)
4a. Does your transplant program have any policies in place regarding clinical management of these patients?	
N-Missing	49
Don't know	3 (3%)
No	69 (77%)
Yes	18 (20%)
Time-frame between treatment and transplant – If "yes" to 1a. Would you consider offering an organ transplant to a patient with a previous history of immunotherapy treatment for cancer?	
	Overall (N=58)
1b. What would you consider an acceptable time-frame between the treatment and transplant?	
<4 months	13 (22%)
4-12 months	31 (53%)
12-24 months	6 (10%)
>24 months	8 (14%)
Number of denied listings - If "yes" to 2. Are you aware of any transplant recipients at your institution that were denied listing for transplantation based on prior immunotherapy exposure?	
	Overall (N=9)
2b. How many such patients are you aware of at your institution?	
1-2	4 (44%)
3-5	4 (44%)
>5	1 (11%)
Transplant recipients with prior immunotherapy – If "yes" to 3. Are you aware of any transplant recipient in your institution that received immunotherapy for cancer before an organ transplant?	
	Overall (N=30)
3b. How many patients are you aware of at your institution received immunotherapy for cancer before an organ transplant?	
1-2	20 (67%)
3-5	4 (13%)
>5	6 (20%)
3c. Approximately when did you transplant your first patient who had received prior immunotherapy for cancer?	
Missing	1
Earlier	2 (7%)
2016	1 (3%)
2017	1 (3%)
2018	8 (28%)
2019	9 (31%)
2020	8 (28%)
3d. In the patients that received an organ transplant after immunotherapy receipt for cancer - what was the immunotherapy treatment for?	
Liver cancer	26 (87%)
Other	4 (13%)
3e. What type of immunotherapy was used	
Missing	1
Don't recall	1 (3%)
Immune checkpoint inhibitor	23 (79%)
Immune system modulator	1 (3%)
Monoclonal antibody	3 (10%)
T-cell transfer therapy	1 (3%)
3k. Graft survival: In your opinion and experience, how do the outcomes of these patients compare to the average transplant patient?	
Missing	1
Have not followed them for enough time to make this determination	10 (35%)
Better	1 (3%)
Same	16 (55%)
Worse	2 (7%)
3l. Patient survival: In your opinion and experience, how do the outcomes of these patients compare to the average transplant patient?	
Missing	1
Have not followed them for enough time to make this determination	11 (38%)
Better	1 (3%)
Same	15 (52%)
Worse	2 (7%)
Time-period between immunotherapy and transplant - If "yes" to 4a. Does your transplant program have any policies in place regarding clinical management of these patients	
	Overall (N=18)
4b. Do you require a certain time period between last dose of immunotherapy and transplant?	
No	4 (22%)
Yes, <6 months	10 (56%)
Yes, 6-12 months	2 (11%)
Yes, 12-24 months	1 (6%)
Yes, >24 months	1 (6%)

Figure: (abstract: SAT286)

SAT287

Evaluating the predictive performance and transferability of machine learning-based prediction models using national liver transplant data registries

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Background and aims: Large, national registries of liver transplant (LT) data are collected in many countries. We compared data from

Harmonized - Cross Country Test Set Performance, Mean (range) across 5 imputations

Model (Country model was trained on)	Registry (Country predictions made on)	AUROC	AUPRC
CA	CA	0.58 (0.57 to 0.60)	0.16 (0.16 to 0.19)
	UK	0.68 (0.67 to 0.70)	0.25 (0.24 to 0.26)
	US	0.57 (0.55 to 0.58)	0.21 (0.18 to 0.24)
UK	CA	0.49 (0.49 to 0.50)	0.04 (0.04 to 0.04)
	UK	0.63 (0.62 to 0.64)	0.05 (0.05 to 0.05)
	US	0.65 (0.65 to 0.65)	0.08 (0.08 to 0.08)
US	CA	0.57 (0.56 to 0.58)	0.05 (0.05 to 0.05)
	UK	0.60 (0.60 to 0.60)	0.05 (0.05 to 0.05)
	US	0.63 (0.63 to 0.63)	0.06 (0.06 to 0.07)

Abbreviations: AUPRC: Area under precision-recall curve, AUROC: Area under receiver-operator characteristic, CA: Canada, UK: United Kingdom, US: United States

Figure: (abstract: SAT287)

three national registries and developed machine learning algorithm (MLA)-based models that were used to evaluate performance predictions both within and across these different countries.
Method: We studied adults (≥18-years) who underwent primary LT between Jan-2008 and Dec-2018 from United Network for Organ Sharing (UNOS-US), National Health Service Blood and Transplantation (NHSBT-UK), and the Canadian Organ Replacement Registry (CORR-Canada). MLA models for 90-day post-LT mortality were built firstly on each individual registry's capacity (based on variables inherent to the individual database) and then based on the overlapping variables available in all three registries (based on harmonized variables). The predictive abilities of the harmonized registry models were evaluated externally across countries using area-under-the-receiver-operator-curve (AUROC) and area-under-the-precision-recall-curve (AUPRC).
Results: The total number of patients were as follows: training (2008–2015) (Canada:n = 827;UK: n = 3, 388;US: n = 40, 454), validation (2016) (Canada:n = 126;UK:n = 621;US:n = 6, 128), and testing (2017–2018) (Canada:n = 261;UK:n = 1, 278;US:n = 12, 976). The best performing MLA-based model was the ElasticNet across both multiply imputed independent and harmonized datasets (best performance in the US:AUROC:0.70;Range:0.70–0.71). Model performance diminished from the independent to the harmonized (only using variables that were in common between the three registries) registries, especially in the UK (independent ElasticNet:AUROC:0.54; Range 0.52–0.56 to harmonized AUROC:0.48; Range:0.48–0.50) and the US (independent ElasticNet:AUROC:0.70;Range:0.70–0.71 to harmonized AUROC:0.65;Range:0.64–0.65). Model performance after external validation across countries was overall poor (Table 1).
Conclusion: MLA-based models can be constructed using international LT registries, with independent ElasticNet models demonstrating optimal predictive performance. While MLA-based model performance yields fair discriminatory potential, a diminishing number of variables and granularity results in decreased performance. Moreover, the external validity of such MLA-based models is poor when applied to other transplant registries. This is likely due to inherent limitations and variability within each dataset. As such, it is conceivable that these limitations may be overcome in the future by increasing the granularity of datasets (for example, with linkages to other administrative datasets), and placing an increased emphasis on consensus for variable standardization (such as with increased collaboration and communications across transplant data collecting organizations).

SAT288

Liver transplant recipients have a higher incidence of lung cancer than general population

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Background and aims: De novo malignancies are frequent complications after liver transplantation. Liver transplant recipients (LTRs) have a higher risk of lung cancer than the general population, but it may be due to a higher frequency of smoking. Our aim was to compare the incidence of lung cancer in LTRs with respect to a matched group of control candidates.
Method: In this retrospective study, 124 LTRs and 496 controls participating in a lung cancer screening program with low-dose computed tomography (LDCT) were compared. Four controls were matched for each LTR according to gender, age (± 10 years), current smoking status, cumulative smoking (± 10 pack-years) and presence of emphysema on initial LDCT examination. The results of our lung cancer screening program in LTRs were also evaluated.
Results: Twelve LTRs (9.7%) and 28 controls (5.6%) were diagnosed with lung cancer. The actuarial risks of lung cancer at 3, 5, 7 and 10 years were 3.3%, 4.5%, 8.3% and 18.2% for LTR and 3%, 3.4%, 4% and 7.1% for controls, respectively (p = 0.038). The most important predisposing factors for lung cancer were a higher age and the presence of emphysema.
Ten of the12 LTRs with lung cancer were diagnosed with stage IA. At the end of the follow-up, six patients had died (two of them from lung cancer progression and one from chemotherapy-related sepsis). Nine patients were free of malignancy at their last follow-up.