

**RE: sample database of anonymised patients. password to follow**

Justin CHOY Yu Min

Sat 9/28/2019 1:22 AM

**To:** Wong Fuh Yong (SingHealth - ONCO) <wong.fuh.yong@singhealth.com.sg>**Cc:** GUO Lingxing <lxguo.2017@sis.smu.edu.sg>; Gan Soon Ann (NCCS) <trdgsa@nccs.com.sg>; CHUA Ming Yu <mingyu.chua.2017@sis.smu.edu.sg>; Tanny LAI <tanny.lai.2017@sis.smu.edu.sg>; Jesslyn CHANG <jesslync.2017@sis.smu.edu.sg>; TAN Jia Yun <jiajun.tan.2017@sis.smu.edu.sg>

In addition, I note your point on the RCA and have browsed through it.  
Will iron it out ASAP and get back to you on this.

Justin

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**From:** Justin CHOY Yu Min**Sent:** Saturday, September 28, 2019 1:19 AM**To:** 'Wong Fuh Yong (SingHealth - ONCO)' <wong.fuh.yong@singhealth.com.sg>**Cc:** GUO Lingxing <lxguo.2017@sis.smu.edu.sg>; 'Gan Soon Ann (NCCS)' <trdgsa@nccs.com.sg>; CHUA Ming Yu <mingyu.chua.2017@sis.smu.edu.sg>; Tanny LAI <tanny.lai.2017@sis.smu.edu.sg>; Jesslyn CHANG <jesslync.2017@sis.smu.edu.sg>; TAN Jia Yun <jiajun.tan.2017@sis.smu.edu.sg>**Subject:** RE: sample database of anonymised patients. password to follow

Hello Dr Wong,

Thank you so much for supporting our project.

We were pretty busy tidying things up for several projects today and just came across your email.

We have also met with the main track coordinator and asked about important matters like NDA, IP rights and ownership of source code.

The meeting went in favor of meeting NCCS's interests and I will update you formally tomorrow, along with a summary of this week's events.

We are excited and thankful to have you as our potential FYP sponsor, and we will do our best to make sure this clears the school's requirements

And gets accepted as a Final year project.

Have a blessed weekend!

Regards,

Justin &amp; team.

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**From:** Wong Fuh Yong (SingHealth - ONCO) <[wong.fuh.yong@singhealth.com.sg](mailto:wong.fuh.yong@singhealth.com.sg)>**Sent:** Friday, September 27, 2019 3:09 PM**To:** Justin CHOY Yu Min <[justin.choy.2017@sis.smu.edu.sg](mailto:justin.choy.2017@sis.smu.edu.sg)>; Gan Soon Ann (NCCS) <[trdgsa@nccs.com.sg](mailto:trdgsa@nccs.com.sg)>; Fong Mun Yee (NCCS) <[fong.mun.yee@nccs.com.sg](mailto:fong.mun.yee@nccs.com.sg)>**Subject:** Re: sample database of anonymised patients. password to follow

Dear Justin,

Our legal reps have looked through this and has agreed for me to release the Research Collaborative Agreement (RCA) for your perusal.

Kindly look through and we can get this signed as soon as possible by our respective bosses and then we can get started on the work. 😊

regards

fuhyong

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**From:** Justin CHOY Yu Min <[justin.choy.2017@sis.smu.edu.sg](mailto:justin.choy.2017@sis.smu.edu.sg)>  
**Sent:** Tuesday, September 24, 2019 7:51:14 PM  
**To:** Wong Fuh Yong (SingHealth - ONCO)  
**Subject:** RE: sample database of anonymised patients. password to follow

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Do not click on links or open files if unsure of sender.

<EXTMSG>

Good evening Dr Wong,

On behalf of the group, thank you for your swift assistance and support for this project.  
The description you have given for the background and the solution is clear and detailed.  
Our group will review the solution aspect and might fine tune it a little after consulting our Analytics professors on the idea.

We really appreciate your time and effort invested, and we are working closely with the school to Complete any necessary administrative processes.  
Will give you an update sometime this Friday.

On a side note, will it be alright for me to forward our emails to my group members?

Regards,  
Justin Choy and Team.

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**From:** Wong Fuh Yong (SingHealth - ONCO) <[wong.fuh.yong@singhealth.com.sg](mailto:wong.fuh.yong@singhealth.com.sg)>  
**Sent:** Tuesday, September 24, 2019 6:04 PM  
**To:** Justin CHOY Yu Min <[justin.choy.2017@sis.smu.edu.sg](mailto:justin.choy.2017@sis.smu.edu.sg)>  
**Cc:** Gan Soon Ann (NCCS) <[trdgsa@nccs.com.sg](mailto:trdgsa@nccs.com.sg)>; Fong Mun Yee (NCCS) <[fong.mun.yee@nccs.com.sg](mailto:fong.mun.yee@nccs.com.sg)>  
**Subject:** sample database of anonymised patients. password to follow

Please see the attached anonymised database as an example of the information available  
This is for 10 patients.

thanks,

fuhyong

Abstract reproduced below:

## Background

National healthcare spending in Singapore has almost tripled from \$3.74 billion in 2010 to \$9.8 billion in 2016 (2.2% of GDP). This is projected to reach \$13 billion in 2020. This unsustainable rate of increase is especially evident in cancer care. Major advancements in cancer diagnostics and treatment have led to significant improvements in clinical outcomes. However, the cost of therapy, including chemotherapy, targeted agents, and more recently, immunotherapy, is substantial and have contributed to some of the largest and most rapid increase in healthcare spending.

In seeking to control these unsustainable increases in healthcare costs, it is imperative that healthcare organizations can predict the likely future costs of individuals, so that care management resources can be efficiently targeted to those individuals at highest risk of incurring significant costs.

Predicting healthcare costs for individuals is important for various stakeholders. For payer, insurers and increasingly healthcare delivery systems, accurate forecasts of likely costs can help with general business planning in addition to prioritizing the allocation of scarce care management resources. Moreover, for patients, knowing the anticipated financial burden may allow their caregivers and them to organize their resources and strategize their spending. This may reduce the impact of financial toxicity and its resultant increased psychosocial distress, diminished patient outcomes, and poorer quality of life

As we move from a fee-for-service payment model to value-based payment model, knowledge of the expected expenditure and the benefits (and harm) it purchase, patients can then be fully engaged in their care and participate fully in the shared decision making process.

We propose the development of an Artificial Intelligence (AI) tool to make individualized predictions of short and long term health expenditure of breast cancer patients and relate this expenditure to the benefits purchased.

## Methods

A large scale, high resolution longitudinal database of deidentified breast cancer patients treated in National Cancer Centre Singapore and her sister institutions within the Singhealth cluster will be made available for the development of this AI. This database includes demographic, pathology and outcomes of breast cancer patients. It also includes details of all treatment rendered including surgery, chemotherapy, radiotherapy, endocrine therapy, targeted therapy and the corresponding billing data. All other expenditure with every encounter with the health system are also recorded.

Different methods of Machine Learning (ML) will be used to develop the AI which may include Linear Regression, Lasso, Ridge, Elastic Net, CART, M5, Random Forest, Bagging, Gradient Boosting, Support Vector Machine (SVM), and Artificial Neural Network (ANN). The results will be compared to a heuristics-based prediction method in a test cohort not used in the development of the AI.

The finalized algorithm will be used to power an application that allows patient and disease related information be entered in order to make individualized predictions of the anticipated expenditure of her subsequent cancer care. Predicted clinical outcomes and the impact of different treatments can be graphed and displayed in a lay-person friendly form. Improvements in patient satisfaction with the communication process will be measured.

This application will be deployed for financial counselling for specific procedures, and short and long term overall expenditure. It will also be deployed in the clinics for medical consultations with doctors, allied health personnels and medical social workers.



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