



17 May 2022

Kia ora [REDACTED]

Your Official Information Act request, reference: GOV-017874

Thank you for your email of 21 April 2022, asking for the following information under the Official Information Act 1982 (the Act):

Can I please be provided with a copy of the:

- ACC Business Rules; and
- The guidelines or service specification/policy / documentation how so ever named that provides the framework for any statistical modelling that the ACC undertakes at the time of acceptance / refusal of a claim and during the course of the claim itself.

Your request has been interpreted as asking for all statistical model business rules, documents, and frameworks used by ACC during the processing of a claim.

Your request is refused due to the large volume of associated documents involved

Providing all information related to statistical modelling used on claims would require substantial collation or research. Your request is therefore refused under section 18(f) of the Act, as the information cannot be made available without substantial collation or research.

In making this decision, we have considered extending our timeframe to respond and charging (under the Act). However, neither of these options have been offered as we have determined that the resources required to extract all the information requested would unreasonably interfere with the everyday functions of the team(s) involved.

However, to provide you with reasonable assistance we have identified and are providing key documents related to the statistical models used by ACC during the processing of a claim.

Cover decision service business rules

The purpose of the Cover Decision Service business rules and model suite is to determine whether a claim constitutes a straightforward injury that can be automatically accepted (automation) or whether the claim requires a manual assessment by a staff member for the purpose of making a claim decision consistent with the Accident Compensation Act.

More information on what rules govern automation is available in the document titled Claims approval - Technical summary which you can access through our site at: www.acc.co.nz/about-us/how-we-collect-and-use-your-information/how-we-use-claim-information/?stage=Live

Documents related to CEFE analytical models are attached to this letter as Appendix 1

CEFE analytical models were built to automate claim cover and process claim lodgement data more efficiently and are the initial models used once a claim is made.

On 12 May 2022, you advised you did not wish to receive the staff names as part of our response. As such, this information has been deemed *out of scope* and removed accordingly.

You will also note on Appendix 2 information on the additional statistical models used.

If you're concerned about this response, please get in touch

You can email me at GovernmentServices@acc.co.nz.

If you are not happy with this response, you can also contact the Ombudsman via info@ombudsman.parliament.nz or by phoning 0800 802 602. Information about how to make a complaint is available at www.ombudsman.parliament.nz

Ngā mihi



Sara Freitag

Acting Manager Official Information Act Services
Government Engagement & Support

CFEE Models Review

Executive Summary

The Client Front End Establishment (CFEE) analytical models were built to automate claim cover and process claim lodgement data more efficiently. The collective models were deployed in September 2018, and are among the first operational analytics models to be deployed in ACC. The models have been in stable operation for the past 12 months.

The initial thresholds for our Cover Decision Service was set to accept 70% of non-specialist claims. The stability and low error rate allowed us to ramp up to accept 90% of non-specialist claims in January 2019.

Our continued monitoring of our Accident Description Service identified some outputs that were impacting on our reporting of Injury Prevention programmes. This was remediated in March 2019, and the services have been reconfigured to correct these issues.

Overall the ACC models have been successfully deployed and continue to be robust and reliable. Our operational reporting coupled with strong governance within the business continue to provide feedback on model performance and accuracy.

Our next steps are to get more information on our model data, and to explore opportunities to improve our models and enable ACC to move off the legacy data warehouses.

As new projects are being established, considerations and changes to CFEE data will need to be identified to support the ongoing accuracy and robustness of the deployed analytic models. For example, dynamic lodgement may include/exclude certain data that is key inputs to the models.

CFEE model headline performance

In the first year of operation 1.18 million claims were automated from claim lodgement to cover acceptance through the CFEE process.

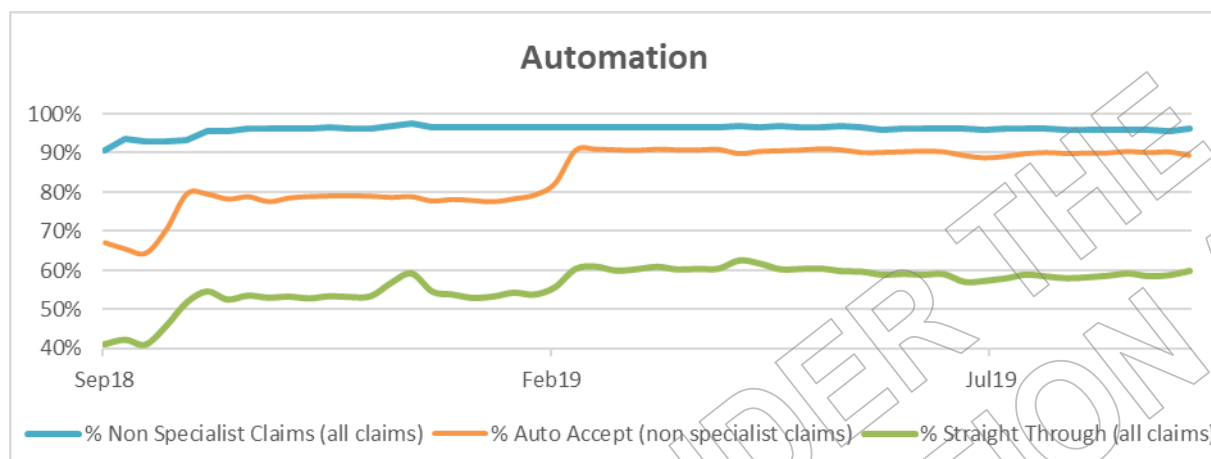
Prior to CFEE simple claim approvals were made on average 14 hours after they were lodged with ACC, now it is around 12.5 hours. This improvement is largely based on the fact that 65% of claims are now approved within an hour of submission (pre CFEE it was less than 20%).

The CFEE models were an important part in achieving these results. This document will explore the performance and accuracy of the models and any further enhancements that could be made.

Cover Decision Service (CDS)

Performance

The targeted performance for the cover decision service was 90% of non-specialist claims to be auto-accepted. The graph below shows the performance against that measure and two important supporting metrics.



% Non-Specialist Claims. ACC typically receives between 40,000 - 50,000 new claims per week. Around 95% of new claims are eligible for cover determination through the CFEE models. The remaining 5% are the specialist claims such as Treatment Injury, Sensitive, Hearing Loss etc. These claim types have complex assessment criteria and are not suitable for automation (using CDS models).

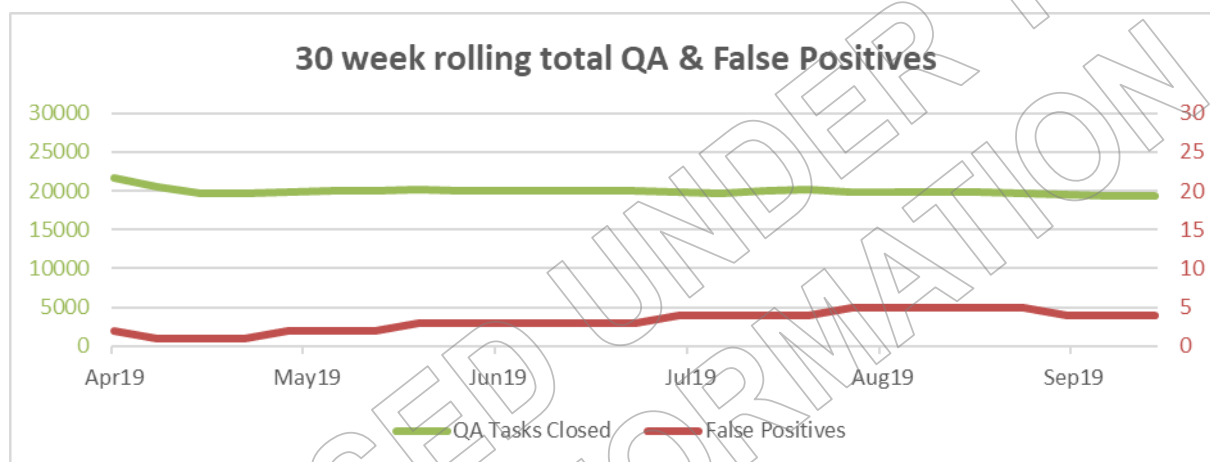
% Auto Accept (of non-specialist claims). This is the performance measure for the cover decision service. Early in CFEE rollout the thresholds controlling the cover decision were set quite high resulting in a 70% acceptance rate. At this level a large amount of work was being sent to the cover teams for assessment which was placing considerable pressure on the team and impacting its performance. The automated decisions were accurate however so the thresholds controlling the automated models were lowered after 4 weeks to archive a higher acceptance rate. They were lowered again in February 2019 to achieve the 90% mark it has remained stable at this point since.

% Straight Through (of all claims). This is the percentage of claims that have no immediate managed requirements i.e. claims that require no human intervention from provider lodgement to cover decision. This claim automation is one of the main drivers of the CFEE project of which the predictive models are an important part, but not the only determinant. This measure is much lower than the auto accept % because a reasonably large number of claims require some kind of manual intervention before the claim is ready for the CDS. This other manual intervention is not model related so is outside the scope of this report. Performance is reasonably stable at around 60% though can be a little volatile week to week depending on what else is happening upstream of the CDS.

Accuracy & Model Drift

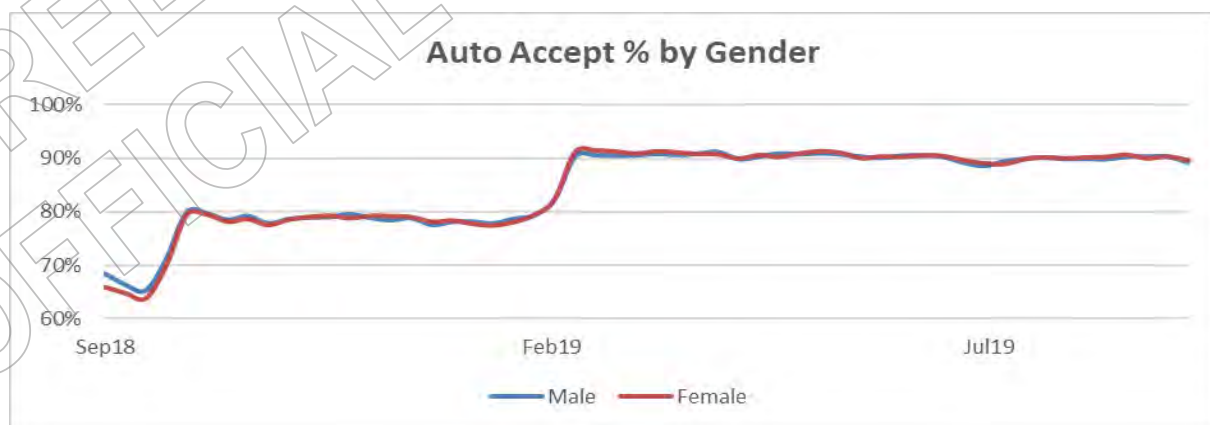
Each week the lodgement team checks ~650 claims which the CDS models have determined to be acceptable. If the lodgement team decide that the claim may need cover assessment they mark the claim and forward it to the cover assessors for consideration. If the cover assessment team decline the claim it is recorded as a false positive. At the time of writing 37,000 claims had been checked, 7 false positives have been found (0.02%).

ACC also monitors for model drift which is when the underlying data changes over time and the models are no longer fit for purpose. Nicholson Consulting recommended that we should rebuild the models when the false positive rate exceeds 30 false positives per 20,000 claims checked. The graph below measures QA tasks (claims checked) and the false positives on those claims over a 30-week rolling period (~20,000 checked claims). The highest recorded false positive rate so far is 5/20000, well below the threshold.

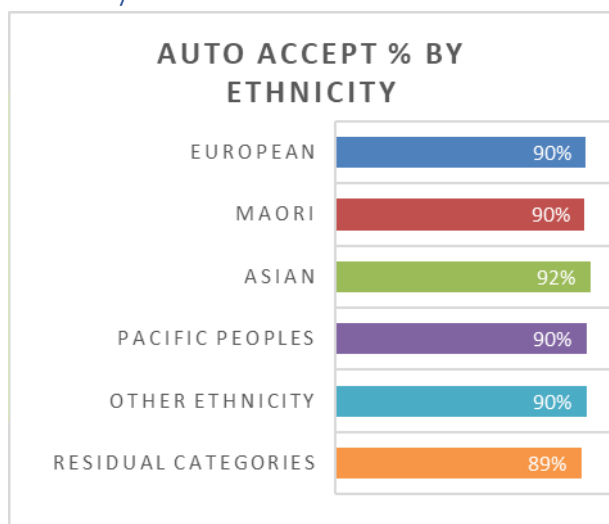


Gender

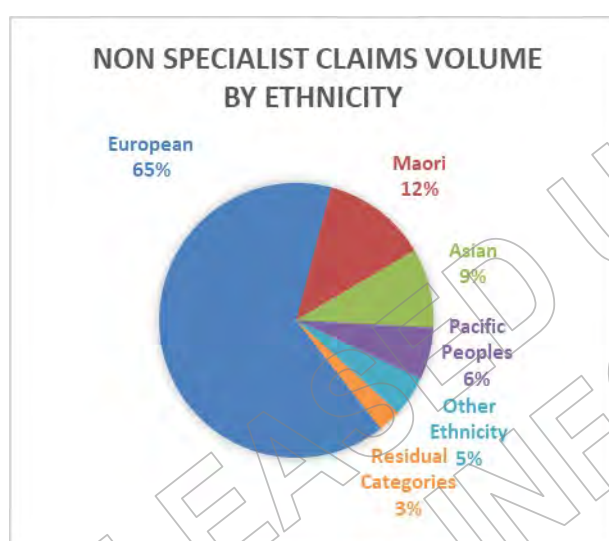
There is no significant difference week to week for auto accept when broken down by gender – both track consistently at the overall auto-accept rate of 90%.



Ethnicity



The auto accept rate for ethnicity is around 90% for all ethnicity groupings. Asian is slightly higher at 92%. This appears to be because there are relatively fewer claims submitted for injury types that ACC usually declines for cover (Hernias, Alcohol & other substances, Sunburn etc).



Issues & Opportunities for Improvement

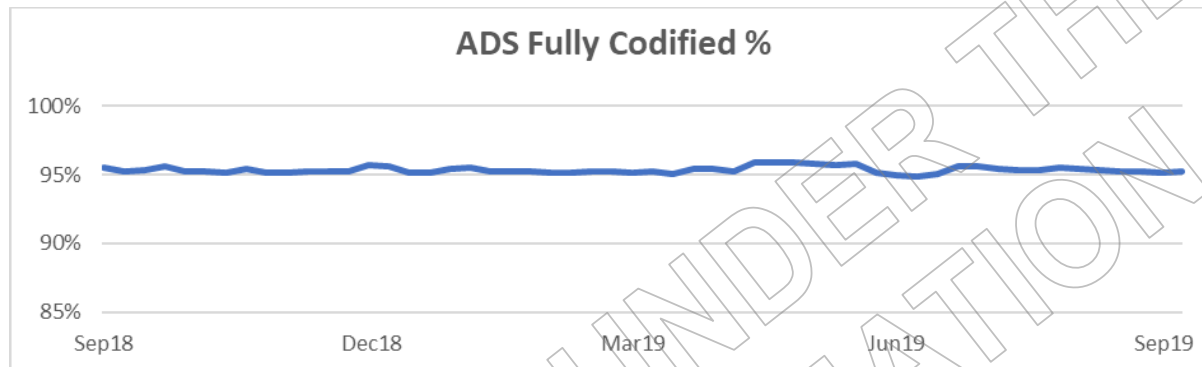
- Currently we can track the CDS model performance by the model outputs only (probability of accept and complexity scores), however we cannot easily track the variables underlying those scores to see how they may be changing over time. It would be ideal to be able to get more detail from BXMS into the data warehouse if possible.
- Most of the false positives so far have been picked up at the audit stage because the accident description did not describe an accident sufficient to cause the injury. The CDS does not have a mechanism to identify this situation. The new text analytics tools provided through Continuous Delivery may offer a solution to close this gap. Its unlikely that this could be integrated as a part of the CDS models but could perhaps be implemented as a kind of more advanced claim type model.

Accident Description Service (ADS)

Performance

The role of the ADS models is to enable claims automation through automatic data entry of the various accident description derived fields (cause, contact, prior activity etc). To achieve this, the threshold for model selection and codification of the field was set low at 50%. Each mandatory field (Cause, Contact, Prior Activity & External Agency) has a default option that was already set above the 50% mark. This ensured that a large number of claims used the default model selections.

Full codification means that no manual intervention is required to enter the mandatory ADS categories (cause, contact, prior activity, external agency). Performance is very stable at around 95%.



Monitoring

The ADS models are monitored weekly for codification % and for deviation from the established pattern. This has allowed A&R to identify system changes following EOS updates that have affected the ADS codification. These issues were raised and corrected. They were not issues with the models themselves but were related to EOS changes & BXMS integration

Issues

Since go live the data in the ADS categories has shifted significantly vs. the previous fully manually coded registration process. There were multiple reasons for this;

- Some categories have been merged/retired
- Some categories have been redefined
- Manual codification was inconsistent over time
- Manual codification was inconsistent person to person
- ADS models were built using inconsistent historical data
- The low threshold and default categories under caused many claims to be put into the default options
- Some ADS models weren't working as intended and needed to be tuned

Unfortunately, these changes have led to some step changes in ADS categories used for the Injury Prevention Return On Investment (ROI) calculation and various Official Information Act requests.

In March 2019 A&R began a remediation process on the ADS models with the goal of correcting some of the ADS results to keep the timeseries consistent for the calculation of the Injury Prevention ROI. 31 (of 229) models from Prior Activity, Cause, External Agency & Sport categories were modified. Detail on which models were changed and what was changed can be found in Appendix 1. These amended models were put into production in early July 2019.

A BXMS change was also made to use the sport contained on the ACC45 if it was available instead of the model outcome. This was put into production in May 2019.

The remediation and the sport form override enabled the creation of a corrected historical dataset which was sufficient to enable the recalculation of the Injury Prevention ROI. Appendix 2 contains some graphs displaying the difference between the old and new ADS models.

Opportunities for Improvement

- There are a very large number of possible ADS selections (i.e. 74 for external agency alone). If the ACC45 is redesigned it would be a very good idea to rationalize the categories into fewer options with clear definitions.
- The sport form override has increased the accuracy of the sport selection as it is using human input from people with first hand knowledge of the accident (i.e. the doctor/client). If this approach could be extended to the other categories in a new ACC45 form then the data would become much more accurate.
- Currently we can only apply the ADS model definitions to claims that were lodged post CFEE. The new SAS text analytics tools available from Continuous Delivery may offer new approaches to categorising the accident description data so that ACC can run those definitions over the entire historical data set. This would be very useful for consistent reporting for OIA requests and instances where we need to recalculate a base line for things like the Injury Prevention (IP) ROI. If it is very effective – it may even eliminate the need for ADS style categorisation at lodgement.
- The remediation work did not include any of the contact or motor vehicle agency fields as they were not used in the IP ROI calculation. These models may benefit from some work though its unclear if they are used for anything.

Claim Type Service

The Claim Type Service is used to route the specialist claim types to the appropriate cover decision team, set up an EOS managed requirement and (in most cases) tick the EOS indicator for that claim type. These are not predictive models like the CDS & ADS but are instead business rules using specific injury codes and/or keywords from the accident description. There are Claim Type Service models for;

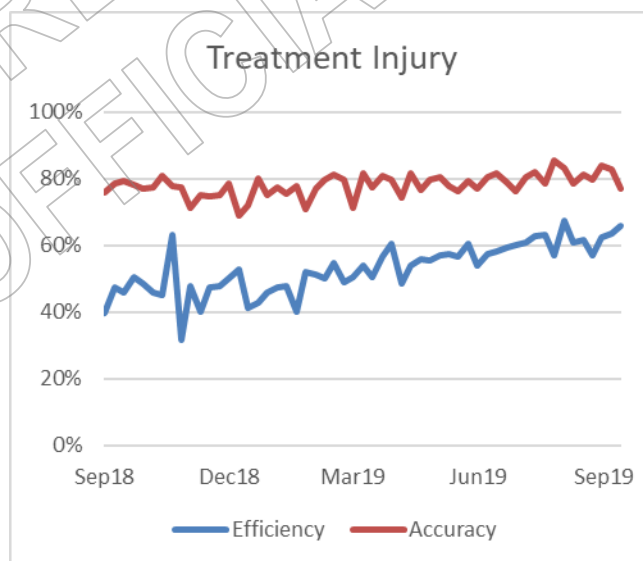
- Dental
- Fatal
- Gradual Process
- Hearing Loss
- Mental Injury
- Sensitive
- Treatment Injury
- Wilfully self-inflicted

Performance, Accuracy & Issues

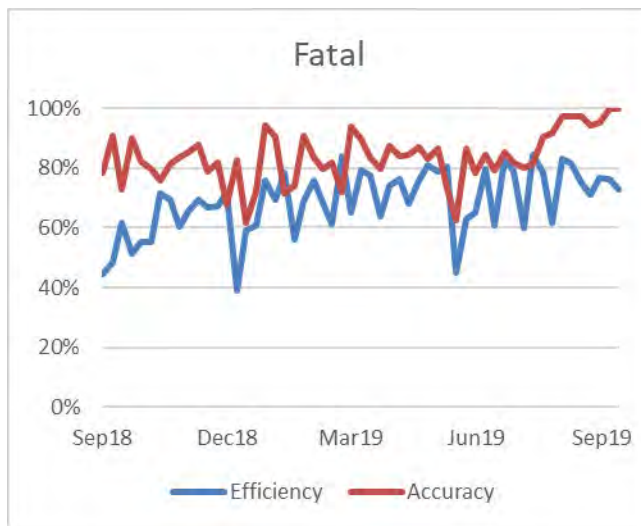
Most of the claim type services can be monitored using the presence of a managed requirement and claim type indicator to define claim type accuracy and efficiency.

Claim type accuracy is measured on the % of claims that have the EOS claim type indicator & had the appropriate managed requirement created at registration. It is a measure of how many of that particular claim type are being picked up at registration by the service. Low accuracy suggests that too many claims are being identified post registration meaning the client may face a wait to receive the appropriate support for their claim.

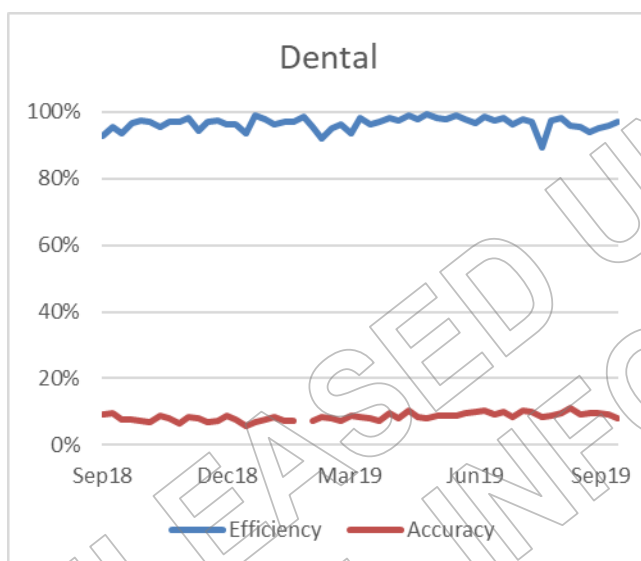
Claim type efficiency is the % of claims registered that week that had a particular managed requirement created and the appropriate EOS claim type indicator is still ticked in EOS (in most cases the EOS indicator can be removed manually post registration). It is a measure of how many claims sent to a particular assessment team are actually for that claim type. Low efficiency suggests that the service is sending too many of the wrong types of claims to a unit and staff time will be wasted triaging.



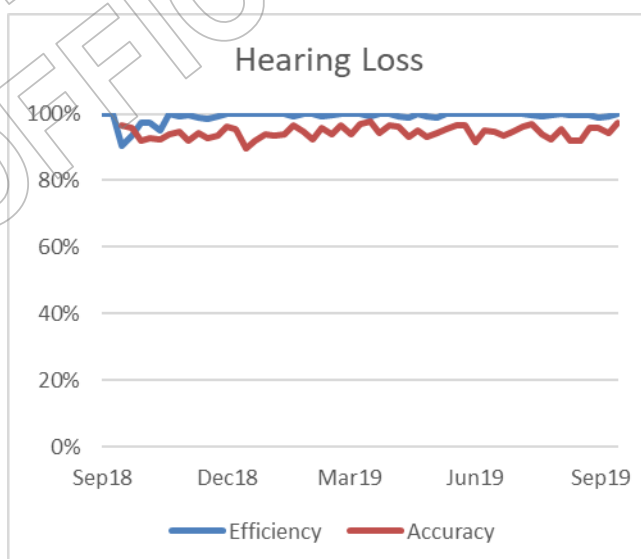
Soon after CFEE went live Treatment Injury (TI) was running at low efficiency. TI is the highest volume specialist claim type so the extra work presented a significant challenge for the team. The main cause of this extra work was due to providers incorrectly ticking the TI indicator box on the ACC45. TI is the only claim type to have an indicator available for providers to use at lodgement. The presence of the indicator on the ACC45 is used by the claim type service to route the claim. Steps have been taken to improve this low efficiency by educating large providers and improving the systems APIs that interact with EOS. TI efficiency has improved steadily through 2019.



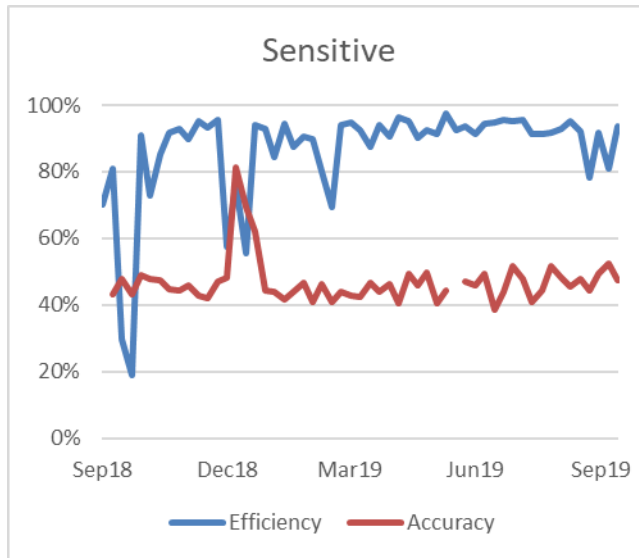
The fatal claim type service has high accuracy and efficiency though the volumes through this team are quite low which is why there can be a high variance week to week for efficiency.



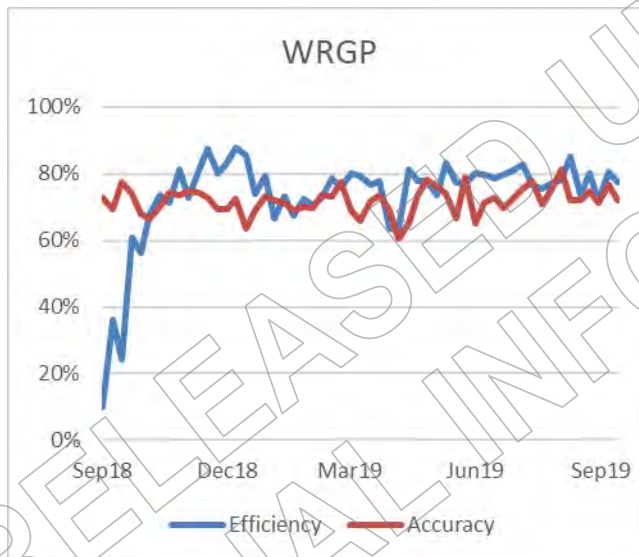
The efficiency/accuracy measures don't work very well for the dental claim type for two reasons. Currently staff are unable to remove the EOS dental indicator which makes the efficiency deceptively high. The claim type service for dental is only meant to identify the complex dental claims however the dental indicator is for all dental claims so there are a large amount of claims with an indicator but no managed requirement which means the accuracy measure is deceptively low. The lodgement remediation project is investigating an EOS fix to allow changes to the dental indicator.



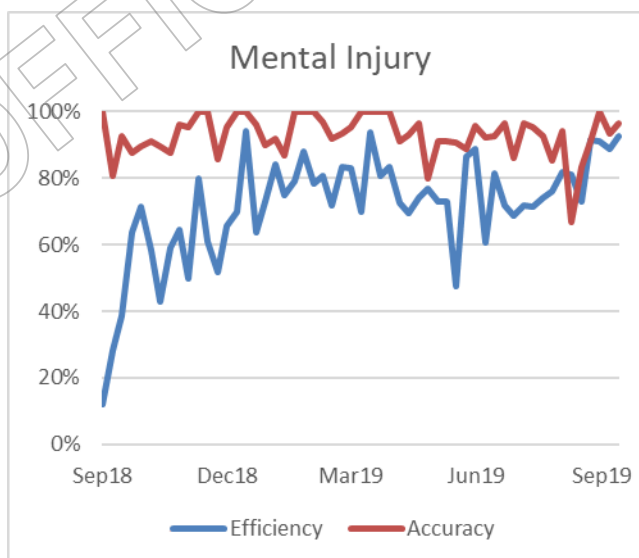
The hearing loss service is very efficient and very accurate. This is because hearing loss claims are identified by a small number of specific injury codes that are only used for occupational noise induced hearing loss.



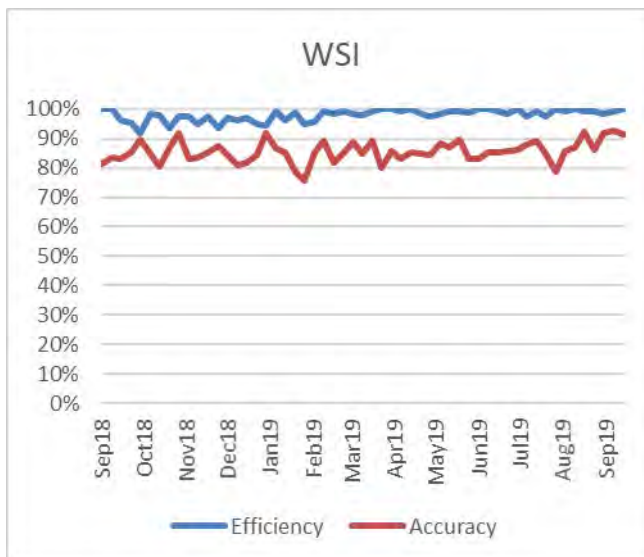
The sensitive claims service is efficient which is important because sensitive claims are the second highest volume of specialist claims. The accuracy appears low. This is because many sensitive claims are lodged with ACC through engagement forms rather than ACC45s so do not go through the CFEE process. Therefore, there a large number of claims that have a sensitive indicator in EOS but do not have a sensitive claim managed requirement.



Work related gradual process has efficiency & accuracy at around 80%. There may be some small changes required soon for this service to pick up silicosis claims.



Mental Injury has good accuracy and reasonably good efficiency.



Wilfully self-inflicted has a very good efficiency and good accuracy.

Opportunities for Improvement

- It might be worth considering creating a claim type service for non-specialist claims. It is reasonably easy to target specific read codes and keywords for assessment for specialist claims using the claim type services. This mechanism is not available for non-specialist claims should we wish to do it. The alternative method is to manually change the p-values for individual variables in the cover decision service but there are many thousands of individual variables in the CDS models which raises the risk for unintended consequences. The claim type models are far quicker and easier to update.
- Another use case for a non-specialist claim type service would be to try and pick up the potential CDS false positives described in the cover decision service section.
- Like the ADS the CTS is a potential use case for the advanced analytics suite from SAS to improve the accuracy of the keyword search and pick up more complex or subtle accident descriptions.

Appendix 1. ADS models changed as part of drop 1.1.2

Prior Activity

448480001 Recreation/Sporting Activity

- Added 25 additional terms to pick up specific sports as this model acts as a prerequisite for the individual sport description models.
- Increased the intercept so that sport is more likely to be selected.

448480018 Receiving Medical Treatment

- Zeroed out NERVE and SUTURE terms as per Nicholson advice.

448480020 Other

- Zeroed GUTTER and CAR terms as per Nicholson advice.

Sport Description

448640041 Aerobics

- Zeroed CLASS

448640037 Volleyball

- Zeroed BALL

448640001 Athletics

- Zeroed SPRINT

448640010 Gymnastics

- New model removed GYM

448640017 Martial Arts

- New Model – added more specific martial arts terms and removed TRAINING

448640023 Polo

- New model – contains only POLO

448640029 Softball, Baseball

- New model – removed BALL

448640036 Underwater Diving

- New model – FREEDIVING corrected to FREEDIVE

448640050 Outdoor Cricket

- New model – added PIN as negative term (to avoid bowl ~ tenpin bowling)

448640083 Other

- New model – added BALL

448640092 ATV

- New model – fewer words. Now focused around more specific ATV terms, fewer general terms like WHEEL, PLAY, ROLL etc.

448640098 Fitness Training / Gym

- New model - added TRAINING

448640104 Kick-boxing

- New model – removed TRAINING

Cause

68896010 Struck by Person/Animal

- New model – added kick terms KICK ON, KICK BY, KICK IN.

68896011 Loss Balance/Personal Control

- Lowered intercept. This model is the default for cause so it has a positive intercept. The intercept was relatively high which meant that too many claims were being selected here. Lowering the intercept closer to 0 depowers the model slightly to let other more appropriate models be selected.

68896025 Object Coming Loose/Shifting

- New model – added terms referring to objects falling on people, as per Nicholson's advice.

68896029 Flooding/Overflow of Liquid

- Intercept was made negative as per Nicholson's advice.

68896036 Medical Treatment

- Zeroed out NERVE and SUTURE terms as per Nicholson advice.

External Agency

448448007 Machinery - Food Processing

- Zeroed out WORK as per Nicholson's advice

448448025 Unpowered Hand Tool NEC

- Zeroed out CUT and DIG

448448026 Vehicle - Car/Van/Utility etc

- New model – added DRIVE as per Nicholson's advice

448448027 Vehicle - Motorcycle/Moped etc

- New model – BIKE Removed as per Nicholson's advice

448448032 Vehicle – Forklift

- New model – contains fewer words now all specific to forklifts and similar vehicles as per Nicholson’s advice.

448448038 Live Dog

- New model – lower scores for DOG and PUPPY

448448041 Other Live Animal NEC

- BIT is stemmed to BITE this model was picking up claims where people were hit by a “bit of” something. Added negative terms for BITE OF and WOOD, GLASS, METAL to correct this.

448448066 Recreation/Sports Equip-Other

- New model - added extra terms for water sport and skiing.

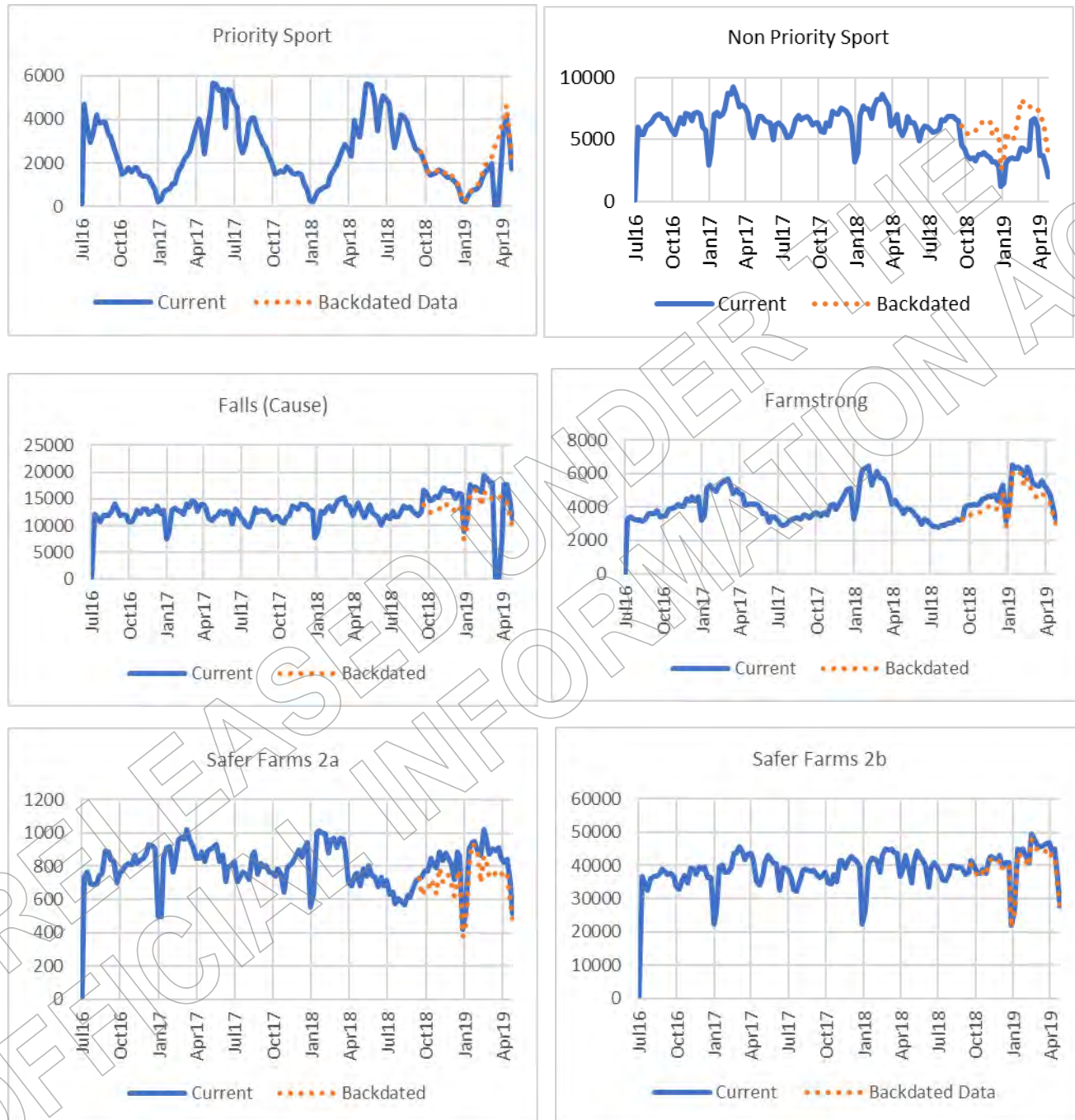
448448071 Health Professional

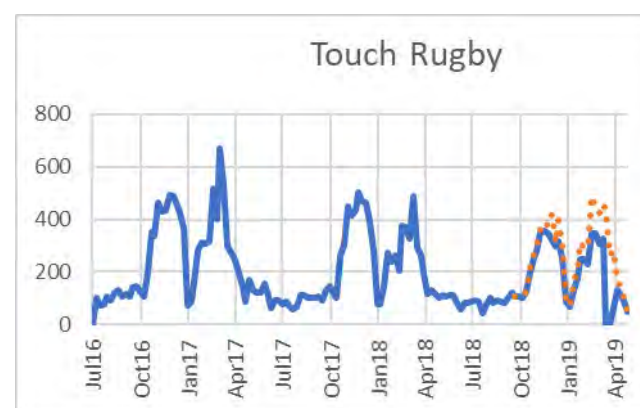
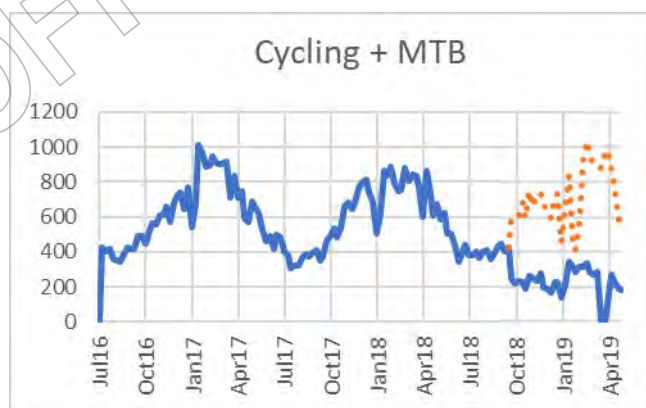
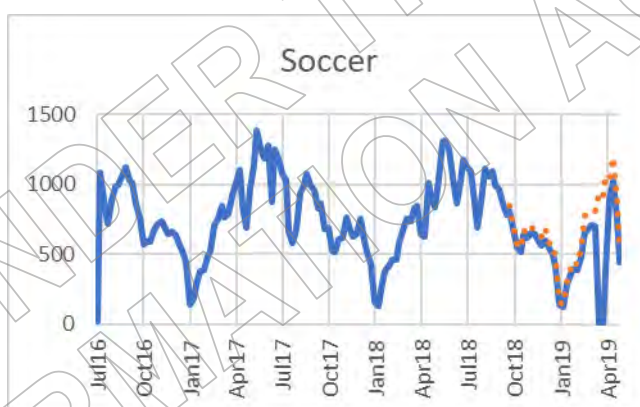
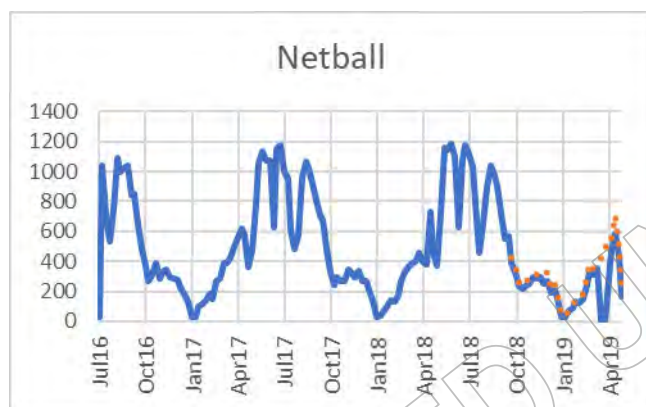
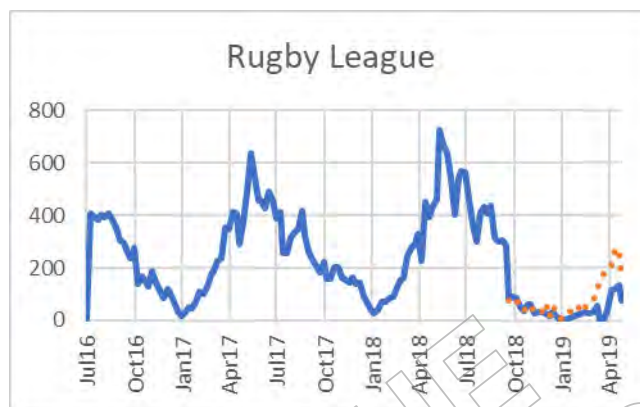
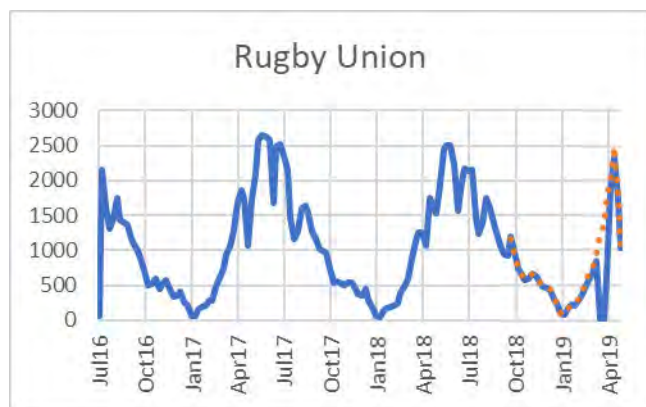
- Zeroed out NERVE and SUTURE terms as per Nicholson advice.

448448073 Other External Agency NEC

- Lowered intercept. This model is the default for external agency so it has a positive intercept. The intercept was relatively high which meant that too many claims were being selected here. Lowering the intercept closer to 0 depowers the model slightly to let other more appropriate models be selected.

Appendix 2. Current Model vs New (backdated) outcomes by injury prevention program







2020 Analytics Model Review - CFEE

Document Owner: [Out of Scope]

Business Owner: [Out of Scope]

Revision Date: 16/12/2020

Version: 1

© Accident Compensation Corporation

Contents

1. Document Control	3
Revision History	3
2. Key People	3
3. Documents Referenced	3
CFEE Model Review 2020	4
Summary	4
Cover Decision Service	4
Automation	4
Accuracy & Model Drift	5
Demographic Bias	5
Accident Description Service	5
Claim Type Service	5
Opportunities for Improvement	5
CDS	5
ADS	6
CTS	6

IN-CONFIDENCE

Document Control

Revision History

Version	Date	Author(s)	Details
1	14/15 October 2020	[Out of Scope]	

Key People

Name	Organisation	Role	Phone	Email
[Out of Scope]	ACC	Senior Analyst	[Out of Scope]	[Out of Scope]@acc.co.nz
[Out of Scope]	ACC	Product Owner	[Out of Scope]	[Out of Scope]@acc.co.nz

Documents Referenced

Document Name	Sharepoint Link

CREE Model Review 2020

Summary

The Client Front End Establishment (CREE) analytical models were built to automate claim cover and process claim lodgement data more efficiently. The models have been in stable operation since September 2018. 2020 has been a much more stable business as usual year for the models when compared to 2019.

Perhaps unsurprisingly the main model changes this year were in response to the Covid-19 lockdown. The cover decision thresholds were lowered and raised around the lockdown to alleviate concerns around resourcing with ACC offices shutdown. It should be noted that these are not really changes to the models themselves just how the business rules implement their output.

Only 1 accident description service (ADS) model was changed (compared to 31 the previous year).

The claim type service (CTS) had 2 changes implemented (both to the dental model).

In the second year of operation the CREE models continue to be robust and reliable and have also proven to be flexible in response to external demands.

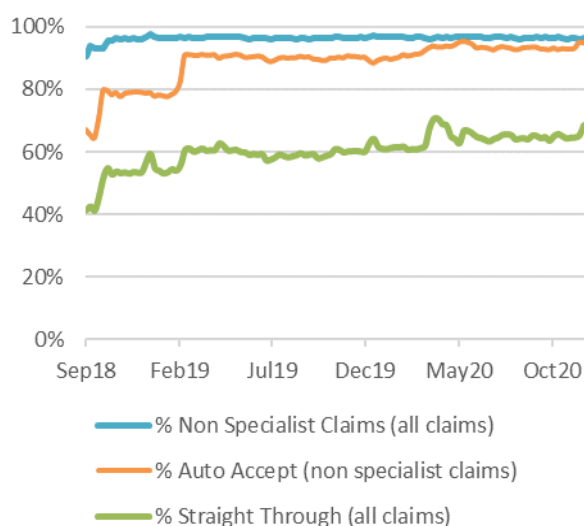
Cover Decision Service

Automation

Prior to lockdown the accept thresholds were set at a target of 90% auto accept (orange line), during lockdown it was raised to 95%, following lockdown it was dropped to 93%. It has recently moved back up to 95% to support new ways of working. The mechanism for all these changes was the lowering of the lower limit of the probability of accept.

Note the raising of the auto accept target has also raised the % of claims lodged without human intervention (green line). This figure now sits around 65% most weeks.

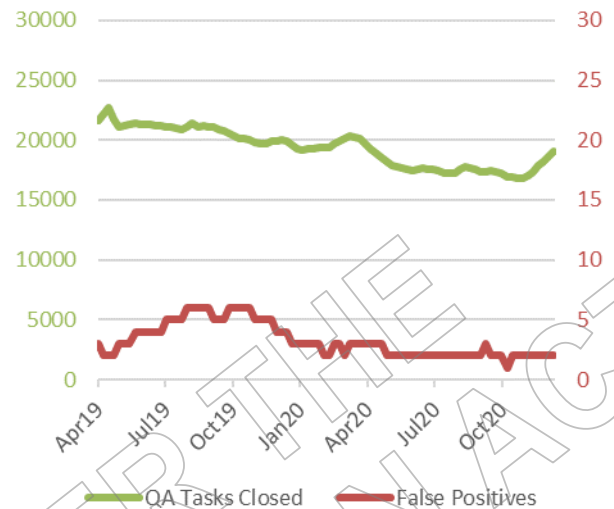
The probability of accept threshold should not be lowered any further, if we need to push the accept % higher there may be scope for increasing the complexity threshold.



IN-CONFIDENCE

Accuracy & Model Drift

Guidelines from Nicholson Consulting recommended recalculating the models if we were finding over 30 false positives per 20,000 audits. We are far below this threshold, so the accuracy of the models remains good. Note the claims drop through lockdown has dropped the 30 week rolling audit total used in the graph but this is not a material issue for accuracy of the models.



Demographic Bias

We monitor the auto accept % by Gender and Ethnicity to check the models aren't producing a bias. There is no significant difference in results by gender or ethnicity, with auto accept % tracking the overall model result.

Accident Description Service

The automation performance for ADS remains good. Fully codified claims are stable at over 95% of total. There has only been 1 ADS model change in the last year which was some very minor additions to the sport/tramping model.

There was however a more significant BXMS change to ensure that the sport fields models will only trigger if Recreation/Sport is selected as the Prior Activity model outcome. This means the automated process now matches the manual registration process for sport injuries. It will also cut down on some of the data and reporting issues from incorrect use of the sport field.

Claim Type Service

Following the lodgement remediation project there were some changes made to the dental claim type model to remove some general mouth injury codes and add some specific dental codes.

The wilfully self-inflicted model will likely be modified to pick up more potential WSI claims at registration. This change will not take effect until 2021.

Opportunities for Improvement

CDS

- There seems to be an appetite for further reducing the number of claims referred for assessment. We believe we have reached the limits of what can be achieved by dropping the probability of accept thresholds. There may be some gains from raising the complexity threshold, but this will raise the risk of more high cost claims slipping through.
- Currently we can track the CDS model performance by the model outputs only (probability of accept and complexity scores), however we cannot easily track the variables underlying those scores to see

IN-CONFIDENCE

how they may be changing over time. It would be ideal to be able to get more detail from BXMS into the data warehouse if possible.

- Most of the false positives so far have been picked up at the audit stage because the accident description did not describe an accident sufficient to cause the injury. The CDS does not have a mechanism to identify this situation. The new text analytics tools provided through Continuous Delivery may offer a solution to close this gap. It's unlikely that this could be integrated as a part of the CDS models but could perhaps be implemented as a kind of more advanced claim type model.

ADS

- There are a very large number of possible ADS selections (i.e. 74 for external agency alone). If the ACC45 is redesigned it would be a very good idea to rationalize the categories into fewer options with clear definitions.
- Currently we can only apply the ADS model definitions to claims that were lodged post CFEE. The new SAS text analytics tools available from Continuous Delivery offer new approaches to categorising the accident description data. This would be very useful for consistent reporting for OIA requests and instances where we need to recalculate a base line for things like the Injury Prevention (IP) ROI. If it is very effective – it may even eliminate the need for ADS style categorisation at lodgement.

CTS

- It might be worth considering creating a claim type service for non-specialist claims. It is reasonably easy to target specific read codes and keywords for assessment for specialist claims using the claim type services. This mechanism is not available for non-specialist claims should we wish to do it. The alternative method is to manually change the p-values for individual variables in the cover decision service but there are many thousands of individual variables in the CDS models which raises the risk for unintended consequences. The claim type models are far quicker and easier to update.
- Like the ADS the CTS is a potential use case for the advanced analytics suite from SAS to improve the accuracy of the keyword search and pick up more complex or subtle accident descriptions.

Memorandum



TO	[Out of Scope]
CC	[Out of Scope]
VIA	[Out of Scope]
FROM	[Out of Scope]
DATE	[Out of Scope]
SUBJECT	ADS Model Change

1 Recommendations

Approve the implementation of new ADS models for Prior Activity: Recreation/Sporting Activity & Sport:Tramping .

2 Issue

Kevin Reynolds from the Customer Analytics team has been in contact with the NZ Mountain Safety Council who are concerned about a drop in recorded tramping accidents since ADS go live.

3 Solution

- Modify the Prior Activity: Recreation/Sporting Activity model to include the word HIKE (the tramping model already included hike).
- Modify the Sport:Tramping model to include the words PLAY, JUMP, BOUNCE as strong negative predictors. This is to decrease the number of trampoline accidents incorrectly coded as tramping.

4 Testing Results

- Model scoring tests based on claims lodged between December 2019 and Feb 2020 using the modified models increased tramping claims by around 25 per week (~15-20% increase).
- End to end simulation testing hasn't been carried out on this relatively minor change but can be (pending availability of the integration team while ACC is working in isolation).

5 Backdating

Backdating the change in the data warehouse is not recommended due to the small number of claims impacted and the relative difficulty and expense of the backdating process. Tramping is also a specific activity that can be identified using keywords/regular expressions.

RELEASED UNDER THE
OFFICIAL INFORMATION ACT

Memorandum



TO	[Out of Scope]
CC	[Out of Scope]
VIA	[Out of Scope]
FROM	[Out of Scope]
DATE	[Out of Scope]
SUBJECT	ADS Model Change

1 Recommendations

2 Approve the implementation of new ADS models and the sport form override. Issue

Post CFEE implementation there has been a large shift in many of the categories handled by the ADS models. This is impacting the calculation of the Injury Prevention (IP) calculation of the return on investment (ROI) for the various programmes that IP run. Analytics & Reporting and Nicholson consulting have reviewed the ADS models to determine where to make changes to achieve a claims allocation that is closer to the pre CFEE distribution for the IP programs. The change integration team have tested these new models and also developed a BXMS update to improve the accuracy of sport allocation.

3 Solution

- Modify the ADS models for Prior Activity, Sport, Cause and External agency. 31 models were modified (see appendix 1 for a list of changes).
- Implement the BXMS rule change developed by the change integration team. This rule selects sport supplied by the provider on ACC45 form if it is available, if it is not available the ADS models will be used.

4 Testing Results

Backdated simulations run by the change integration show that the improved ADS models & sport form selection have resulted in corrections to the claims volumes for the IP programs that were targeted (see appendix 2 for details).

5 Codification Level

The backdating simulation returned a 96% full codification rate which is consistent with the current level.

6 Backdating

A backdated data set has been created for the period from CFEE go live until the end of April. Injury prevention used this data recalculate their ROI. Post implementation this data set will be updated to include the period from 1 May up to the implementation date. A&R is investigating the feasibility of using this data to backdate the EOS values.

7 Business Rules

BPI has been contacted about adding the sport form override to the EBR as this is a new step in the ADS codification business rules.

8 Learnings

- The ADS models cannot assess context so there will always be an inherent inaccuracy using the models. The BXMS rule change for the sport category is a good companion piece as it helps correct ADS shortcomings as it has been selected by a human. It would be ideal if this approach could be extended to the other categories, though this will have to wait until CFEE phase 2 as there is currently no way for the provider to designate a specific Cause, Prior Activity, External Agency etc.
- The pre CFEE data for some categories is inaccurate/inconsistent. It's not always safe to assume that it was correct pre CFEE and incorrect post CFEE.
- The categories that ADS populate are used for a wide range of reporting throughout ACC unfortunately the inconsistent data entry in the past and shortcomings of the ADS models mean that reporting using these categories can be unreliable. The text analytics tools available in Analytics 2.0 offer more powerful methods of extracting data from unstructured text such as the accident description. These techniques/tools may offer a better more reliable reporting solution than using this historic categorical data.

Appendix 1. ADS models changed as part of drop 1.1.2

Prior Activity

448480001 Recreation/Sporting Activity

- Added 25 additional terms to pick up specific sports as this model acts as a prerequisite for the individual sport description models.
- Increased the intercept so that sport is more likely to be selected.

448480018 Receiving Medical Treatment

- Zeroed out NERVE and SUTURE terms as per Nicholson advice.

448480020 Other

- Zeroed GUTTER and CAR terms as per Nicholson advice.

Sport Description

448640041 Aerobics

- Zeroed CLASS

448640037 Volleyball

- Zeroed BALL

448640001 Athletics

- Zeroed SPRINT

448640010 Gymnastics

- New model removed GYM

448640017 Martial Arts

- New Model – added more specific martial arts terms and removed TRAINING

448640023 Polo

- New model – contains only POLO

448640029 Softball, Baseball

- New model – removed BALL

448640036 Underwater Diving

- New model – FREEDIVING corrected to FREEDIVE

448640050 Outdoor Cricket

- New model – added PIN as negative term (to avoid bowl ~ tenpin bowling)

448640083 Other

- New model – added BALL

448640092 ATV

- New model – fewer words. Now focused around more specific ATV terms, fewer general terms like WHEEL, PLAY, ROLL etc.

448640098 Fitness Training / Gym

- New model - added TRAINING

448640104 Kick-boxing

- New model – removed TRAINING

Cause

68896010 Struck by Person/Animal

- New model – added kick terms KICK ON, KICK BY, KICK IN.

68896011 Loss Balance/Personal Control

- Lowered intercept. This model is the default for cause so it has a positive intercept. The intercept was relatively high which meant that too many claims were being selected here. Lowering the intercept closer to 0 depowers the model slightly to let other more appropriate models be selected.

68896025 Object Coming Loose/Shifting

- New model – added terms referring to objects falling on people, as per Nicholson's advice.

68896029 Flooding/Overflow of Liquid

- Intercept was made negative as per Nicholson's advice.

68896036 Medical Treatment

- Zeroed out NERVE and SUTURE terms as per Nicholson advice.

External Agency

448448007 Machinery - Food Processing

- Zeroed out WORK as per Nicholson's advice

448448025 Unpowered Hand Tool NEC

- Zeroed out CUT and DIG

448448026 Vehicle - Car/Van/Utility etc

- New model – added DRIVE as per Nicholson’s advice

448448027 Vehicle - Motorcycle/Moped etc

- New model – BIKE Removed as per Nicholson’s advice

448448032 Vehicle – Forklift

- New model – contains fewer words now all specific to forklifts and similar vehicles as per Nicholson’s advice.

448448038 Live Dog

- New model – lower scores for DOG and PUPPY

448448041 Other Live Animal NEC

- BIT is stemmed to BITE this model was picking up claims where people were hit by a “bit of” something. Added negative terms for BITE OF and WOOD, GLASS, METAL to correct this.

448448066 Recreation/Sports Equip-Other

- New model - added extra terms for water sport and skiing.

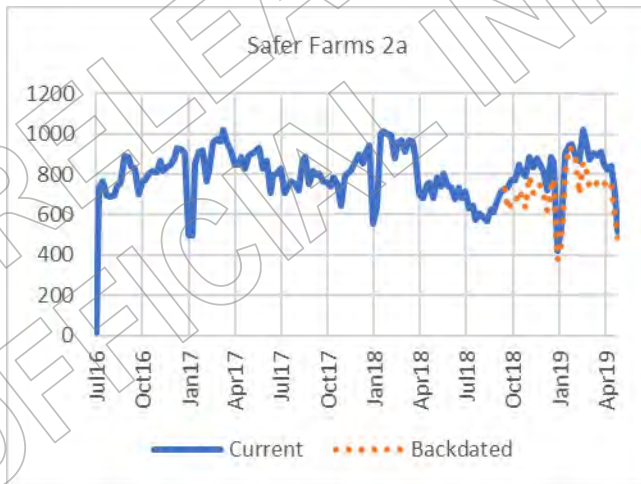
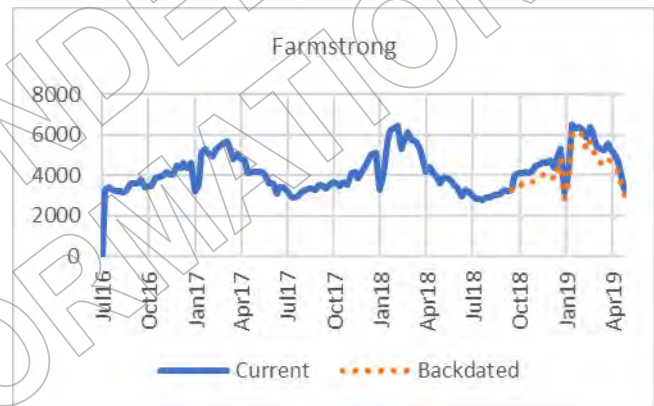
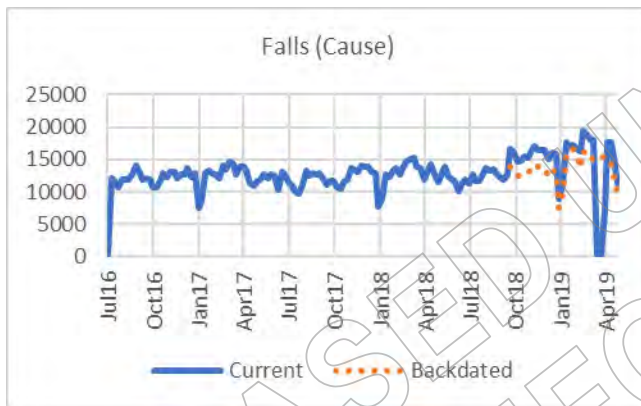
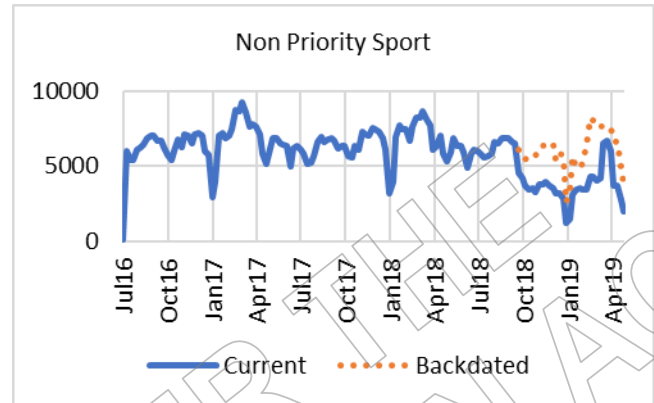
448448071 Health Professional

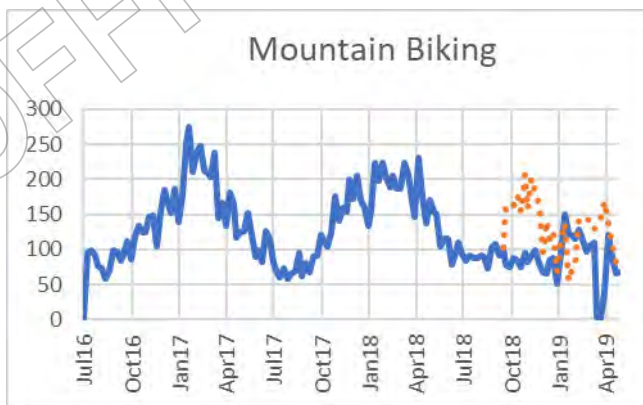
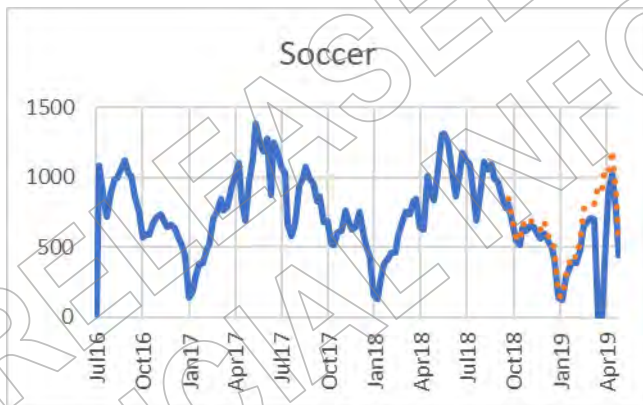
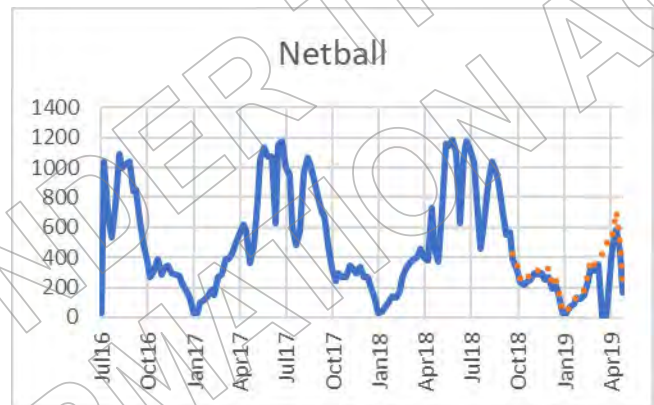
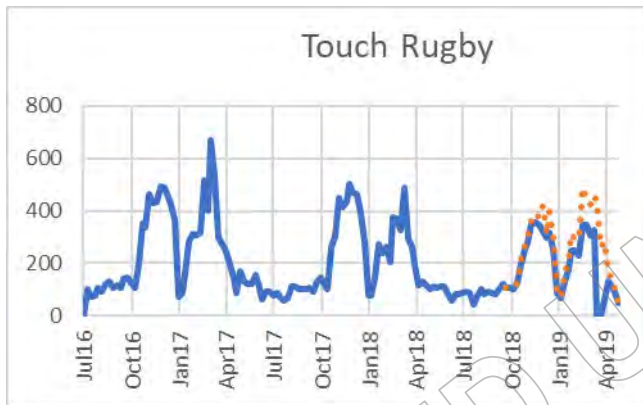
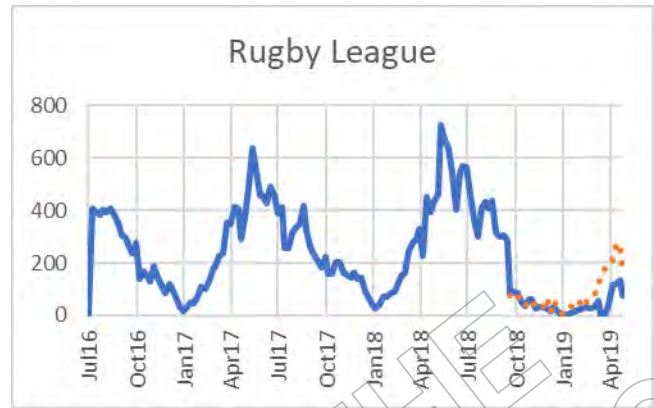
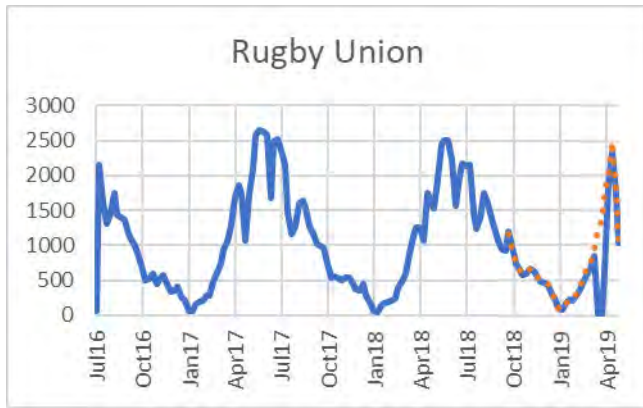
- Zeroed out NERVE and SUTURE terms as per Nicholson advice.

448448073 Other External Agency NEC

- Lowered intercept. This model is the default for external agency so it has a positive intercept. The intercept was relatively high which meant that too many claims were being selected here. Lowering the intercept closer to 0 depowers the model slightly to let other more appropriate models be selected.

Appendix 2. Current Model vs New (backdated) outcomes by injury prevention program





Memorandum



TO	[Out of Scope]
CC	[Out of Scope]
VIA	[Out of Scope]
FROM	[Out of Scope]
DATE	[Out of Scope]
SUBJECT	ADS Model Change

1 Recommendations

Approve the implementation of new ADS models and the sport form override.

2 Issue

Post CFEE implementation there has been a large shift in many of the categories handled by the ADS models. This is impacting the calculation of the Injury Prevention (IP) KPIs. Analytics & Reporting and Nicholson consulting have reviewed the ADS models to determine where to make changes to achieve a claims allocation that is closer to the pre CFEE distribution for the IP programs. The change integration team have tested these new models and also developed a BXMS update to improve the accuracy of sport allocation.

3 Solution

- Modify the ADS models for Prior Activity, Sport, Cause and External agency. 31 models were modified (see appendix 1 for a list of changes).
- Implement the BXMS rule change developed by the change integration team. This rule selects sport supplied by the provider on ACC45 form if it is available, if it is not available the ADS models will be used.

4 Testing Results

Backdated simulations run by the change integration show that the improved ADS models & sport form selection have resulted in corrections to the claims volumes for the IP programs that were targeted (see appendix 2 for details).

5 Injury Prevention KPI Recalculation

Injury prevention has been supplied with a backdated claims data set based which was created as part of the testing process. They have recalculated the estimate of claims saved to be approximately 8,385 which is in line with what was expected pre CFEE and is on target to meet end of year claims target (as per board report).

6 Efficiency

The backdating simulation returned a 96% full codification rate which is consistent with the current level.

7 Backdating

A backdated data set has been created for the period from CFEE go live until the end of April. Post implementation this data set will be updated to include the period from 1 May up to the implementation date. A&R is investigating the feasibility of using this data to backdate values into EOS.

8 Business Rules

BPI has been contacted about adding the sport form override to the EBR as this is a new step in the ADS codification business rules.

9 Wider Consultation

In early April A&R sent communication out via email about the various pieces of CFEE data remediation underway including the ADS model updates. This was sent to representatives from Injury Prevention, Finance, Integrity Services, Research & Evaluation, Customer Analytics, Policy and Actuarial Services. The consensus opinion was to implement as soon as practical.

10 Next steps

Monitoring

- The modified models will be monitored as part of the BAU monitoring to ensure that the claims distribution shifts to match a distribution similar to that seen in the testing data.

Further modification of models

- The models that make up Contact, External Agent 1 & External Agent 2 categories were not modified as part of this piece of work as they were not integral to the IP calculations. They could benefit from some further refinement if required.

Potential enhancements

- The ADS models cannot assess context so there will always be an inherent inaccuracy using the models. The BXMS rule change for the sport category is a good companion piece as it helps correct some ADS shortcomings. It would be ideal if this approach could be extended to the other categories, though this will have to wait until CFEE phase 2 as there is currently no way for the provider to designate a specific Cause, Prior Activity, External Agency etc.
- The categories that ADS populate are used for a wide range of reporting throughout ACC unfortunately the inconsistent data entry in the past and limitations of the ADS models mean that reporting using these categories can be unreliable. The text analytics tools available as part of

Analytics 2.0 offer more powerful methods of extracting data from unstructured text such as the accident description. These techniques/tools may offer a better more reliable reporting solution than using this historic categorical data.

- The SAS text analytics tools may also offer ways to enhance the ADS models themselves to better deal with natural language concepts like context and sentiment. Though this option will require an appropriate investment in upskilling ACC staff.

RELEASED UNDER THE
OFFICIAL INFORMATION ACT

Appendix 1. ADS models changed as part of drop 1.1.2

Prior Activity

448480001 Recreation/Sporting Activity

- Added 25 additional terms to pick up specific sports as this model acts as a prerequisite for the individual sport description models.
- Increased the intercept so that sport is more likely to be selected.

448480018 Receiving Medical Treatment

- Zeroed out NERVE and SUTURE terms as per Nicholson advice.

448480020 Other

- Zeroed GUTTER and CAR terms as per Nicholson advice.

Sport Description

448640041 Aerobics

- Zeroed CLASS

448640037 Volleyball

- Zeroed BALL

448640001 Athletics

- Zeroed SPRINT

448640010 Gymnastics

- New model removed GYM

448640017 Martial Arts

- New Model – added more specific martial arts terms and removed TRAINING

448640023 Polo

- New model – contains only POLO

448640029 Softball, Baseball

- New model – removed BALL

448640036 Underwater Diving

- New model – FREEDIVING corrected to FREEDIVE

448640050 Outdoor Cricket

- New model – added PIN as negative term (to avoid bowl ~ tenpin bowling)

448640083 Other

- New model – added BALL

448640092 ATV

- New model – fewer words. Now focused around more specific ATV terms, fewer general terms like WHEEL, PLAY, ROLL etc.

448640098 Fitness Training / Gym

- New model - added TRAINING

448640104 Kick-boxing

- New model – removed TRAINING

Cause

68896010 Struck by Person/Animal

- New model – added kick terms KICK ON, KICK BY, KICK IN.

68896011 Loss Balance/Personal Control

- Lowered intercept. This model is the default for cause so it has a positive intercept. The intercept was relatively high which meant that too many claims were being selected here. Lowering the intercept closer to 0 depowers the model slightly to let other more appropriate models be selected.

68896025 Object Coming Loose/Shifting

- New model – added terms referring to objects falling on people, as per Nicholson's advice.

68896029 Flooding/Overflow of Liquid

- Intercept was made negative as per Nicholson's advice.

68896036 Medical Treatment

- Zeroed out NERVE and SUTURE terms as per Nicholson advice.

External Agency

448448007 Machinery - Food Processing

- Zeroed out WORK as per Nicholson's advice

448448025 Unpowered Hand Tool NEC

- Zeroed out CUT and DIG

448448026 Vehicle - Car/Van/Utility etc

- New model – added DRIVE as per Nicholson’s advice

448448027 Vehicle - Motorcycle/Moped etc

- New model – BIKE Removed as per Nicholson’s advice

448448032 Vehicle – Forklift

- New model – contains fewer words now all specific to forklifts and similar vehicles as per Nicholson’s advice.

448448038 Live Dog

- New model – lower scores for DOG and PUPPY

448448041 Other Live Animal NEC

- BIT is stemmed to BITE this model was picking up claims where people were hit by a “bit of” something. Added negative terms for BITE OF and WOOD, GLASS, METAL to correct this.

448448066 Recreation/Sports Equip-Other

- New model - added extra terms for water sport and skiing.

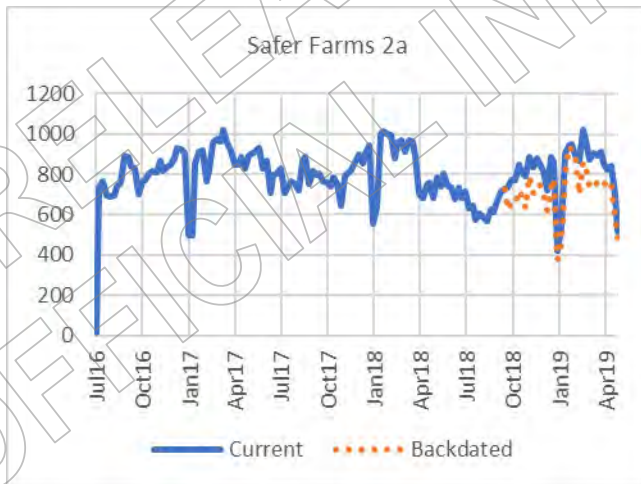
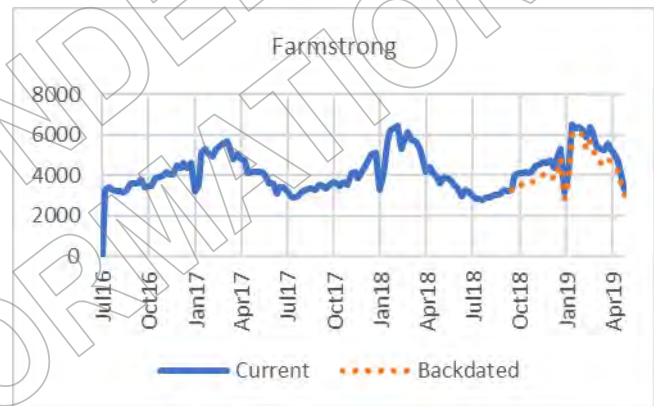
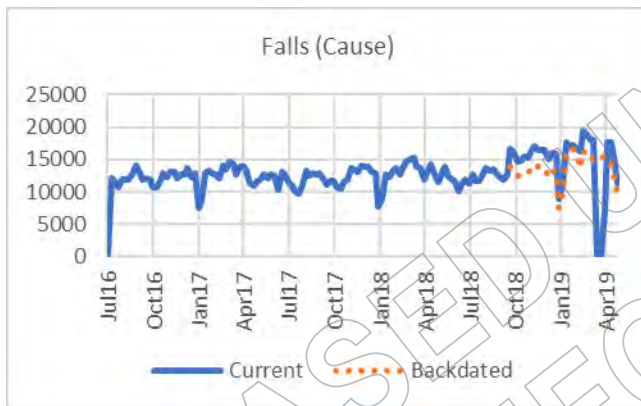
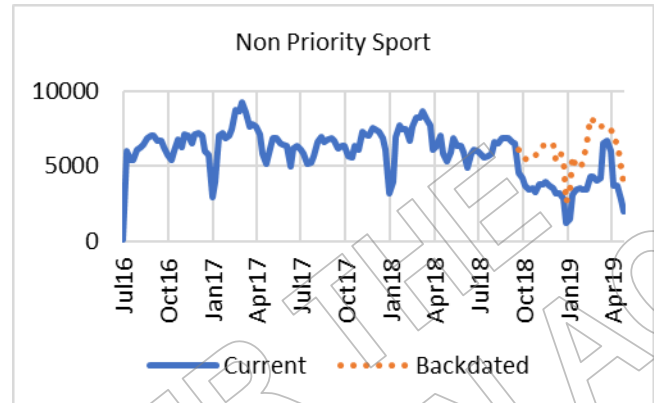
448448071 Health Professional

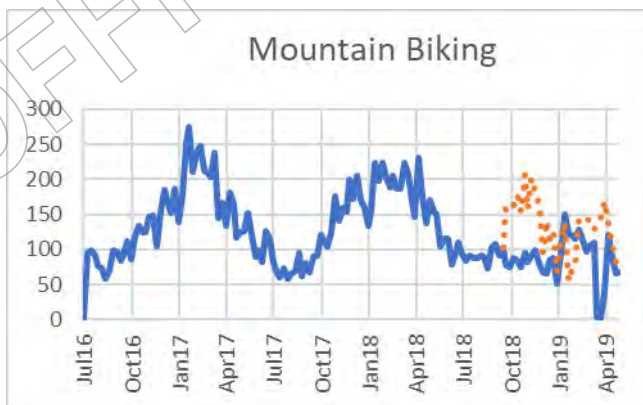
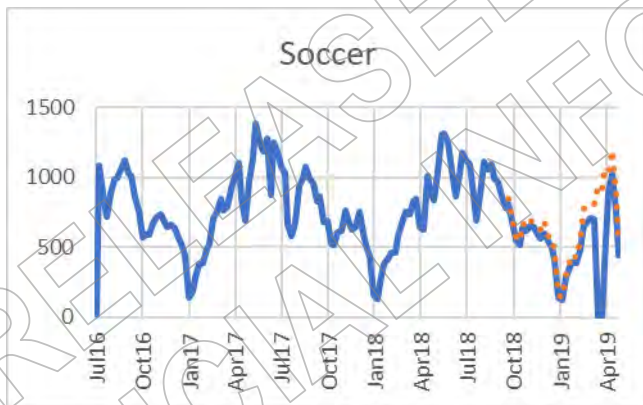
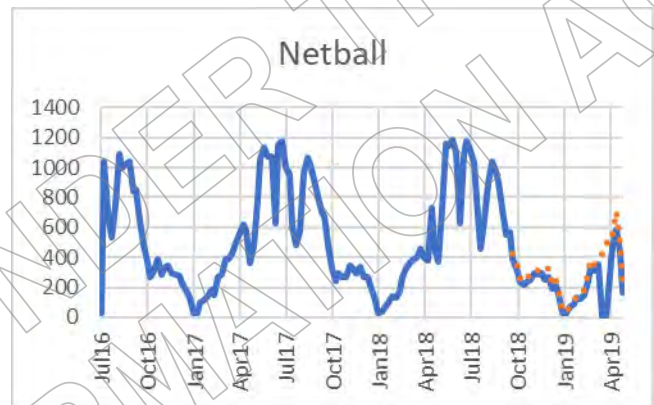
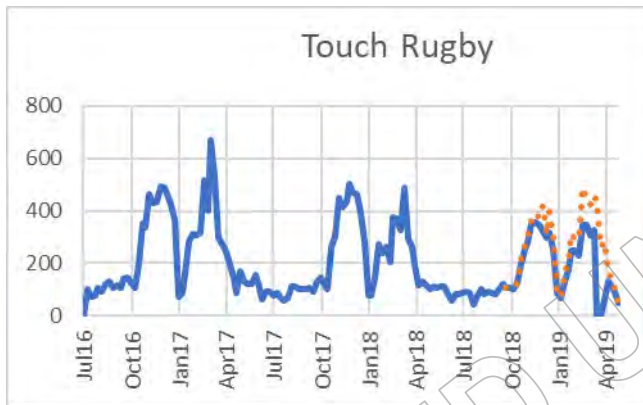
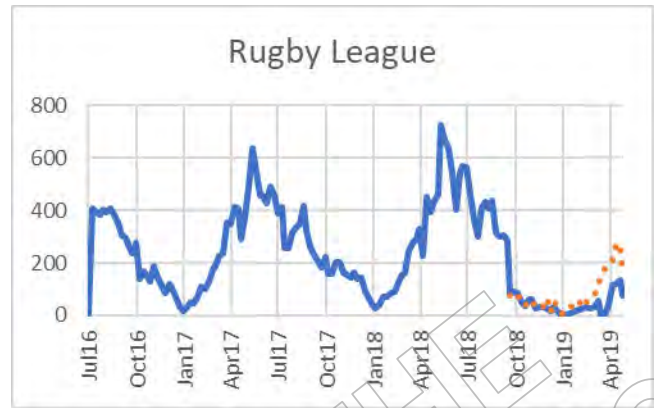
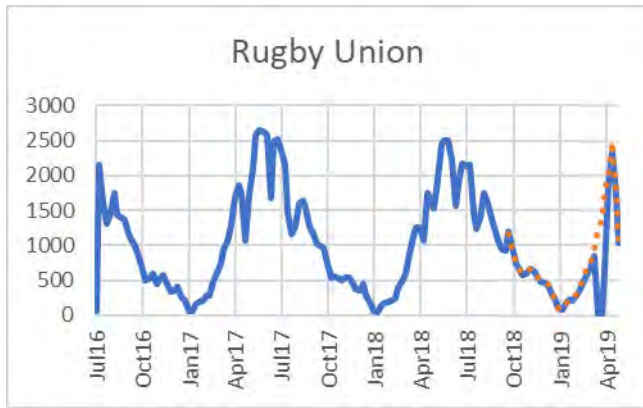
- Zeroed out NERVE and SUTURE terms as per Nicholson advice.

448448073 Other External Agency NEC

- Lowered intercept. This model is the default for external agency so it has a positive intercept. The intercept was relatively high which meant that too many claims were being selected here. Lowering the intercept closer to 0 depowers the model slightly to let other more appropriate models be selected.

Appendix 2. Current Model vs New (backdated) outcomes by injury prevention program





Memorandum



TO	[Out of Scope]
CC	[Out of Scope]
VIA	[Out of Scope]
FROM	[Out of Scope]
FILE REFERENCE	
DATE	29 January 2020
SUBJECT	Claim Type Model Update

1. Recommendation

Approve the implementation of new dental & complex dental claim type models.

2. Issue

There are 2 dental claim type models;

- The “Dental” claim type model will flag a claim as dental but does not stream that claim to a specialist dental team (the claim proceeds through the CFEE BAU process).
- The “Complex Dental” claim type model will flag a model as dental and streams the claim to a specialist dental team.

The lodgement remediation project has identified a number of injury codes that should be added or removed from the live dental claim type models. This will ensure that the dental claim type lists in Fineos and BXMS match as closely as possible. If the lists do not match it can lead to inconsistencies with the dental claim flag for new claims vs additional injury codes added post registration.

3. Solution

Change the “Dental” model as per the table below

Code Type	Code	Action	# of claims in 2019 calendar year
READ	J08z1	Remove	16
READ	J08z0.	Remove	7
ICD9	802.2	Add	0
ICD9	920	Add	0

Change the "Complex Dental" model as per the table below.

Code Type	Code	Action	# of claims in 2019 calendar year
ICD9	525.1	Add	0
ICD9	525.9	Add	0
ICD9	873.63	Add	0
ICD9	873.65	Add	0
ICD10	K081	Add	4
ICD10	K089	Add	2

4. Communication

The SMEs that identified the issue will communicate to the dental teams that this fix is being investigated/solved.

Memorandum



TO	[Out of Scope]
CC	[Out of Scope]
VIA	[Out of Scope]
FROM	[Out of Scope]
FILE REFERENCE	
DATE	22 October 2019
SUBJECT	Claim Type Model Update

1. Recommendation

Approve the implementation of a new gradual process claim type model that includes two additional words related to silicosis.

2. Issue

The gradual process teams have been informed that providers will be more likely to lodge potential silicosis claims. There is no specific read/icd code to identify this injury type so extra key words will be required to identify these claims and stream them to the gradual process team.

3. Solution

Update the gradual process claim type model to include the words SILICA and SILICOSIS

4. Communication

The gradual process team leader has raised this issue and the proposed fix and will communicate it to the cover assessment teams.

Memorandum



TO	[Out of Scope]
CC	[Out of Scope]
VIA	[Out of Scope]
FROM	[Out of Scope]
FILE REFERENCE	
DATE	23 February 2020
SUBJECT	Claim Type Model Update

1. Recommendation

Approve the implementation of new Hearing Loss claim type model.

2. Issue

Read code SN30. (Barotrauma) is currently included in the hearing loss claim type model. Any claims with this code are flagged as hearing loss and sent to the hearing loss team for cover assessment. In some cases these claims contain multiple other serious (not hearing loss) injuries, these cases may face significant delay while sitting in the hearing loss queue.

3. Solution

Remove SN30 from the hearing loss claim type model. This would mean that claims with barotrauma would be treated like a standard PICBA claim and would be subject to the cover decision service models, some would fall out for cover assessment though most would be automatically accepted.

In the 2020 calendar year there were 634 claims with SN30. as lowest scoring code for probability of accept (i.e. what model uses for auto accept if it's not a specialist cover claim). Of those 634 claims 515 had scores that would be auto accepted (under current thresholds), 119 would go through to the picba cover teams for assessment. Equivalent to ~2 claims a week, ~3 if we make some allowances for 2020s low claim volume.

However of those 515 that would have been auto accepted 28 were declined so a false positive rate of around 4%.

Memorandum



TO	[Out of Scope]
CC	[Out of Scope]
VIA	[Out of Scope]
FROM	[Out of Scope]
FILE REFERENCE	
DATE	4 Jun 2019
SUBJECT	Claim Type Model Update

1. Recommendation

Approve the implementation of new injury prevention claim type model that includes the new replacement ICD10 codes.

2. Issue

The ICD10 code set is being updated with changes that go live in July 2019. There are 12 ICD10 codes that are currently used in the treatment injury claim type model that are being replaced with new versions. If we do not update the claim type service, there is a risk that some injury prevention claims will not be correctly allocated for cover decision.

3. Solution

Update the treatment injury claim type service with the codes (see appendix 1). Note the old versions of the codes will remain in the service as the rollout of the new ICD10 version will be gradual.

4. Consultation

The treatment injury unit has confirmed that these codes are appropriate and claims containing the replacement codes should be sent to treatment injury for assessment.

Appendix 1 list of treatment injury codes being replaced in ICD10 update.

code type	Original code	Original Description	New Code	Replacement Description
ICD10	G971	Other reaction to spinal and lumbar puncture	G9719	Reaction to spinal and lumbar puncture, not elsewhere classified
ICD10	N998	Other postprocedural disorders of genitourinary system	N9989	Other intraoperative and postprocedural disorder of genitourinary system
ICD10	O295	Other complications of spinal and epidural anaesthesia during pregnancy	T8859	Complications of anaesthesia, not elsewhere classified
ICD10	O746	Other complications of spinal and epidural anaesthesia during labour and delivery	T8859	Complications of anaesthesia, not elsewhere classified
ICD10	T8141	Wound infection following a procedure	T814	Wound infection following a procedure, not elsewhere classified
ICD10	T8142	Sepsis following a procedure	A419	Sepsis, unspecified
ICD10	T818	Other complications of procedures, not elsewhere classified	T8189	Other complications following a procedure, not elsewhere classified
ICD10	T825	Mechanical complication of other cardiac and vascular devices and implants	T8259	Mechanical complication of other specified cardiac and vascular devices and implants
ICD10	T827	Infection and inflammatory reaction due to other cardiac and vascular devices, implants and grafts	T8279	Infection and inflammatory reaction due to cardiac and vascular devices, implants and grafts, not elsewhere classified
ICD10	T848	Other complications of internal orthopaedic prosthetic devices, implants and grafts	T8489	Other specified complications following insertion of internal orthopaedic prosthetic devices, implants and grafts
ICD10	T856	Mechanical complication of other specified internal prosthetic devices, implants and grafts	T8569	Mechanical complication of internal prosthetic devices, implants and grafts, not elsewhere classified
ICD10	T885	Other complications of anaesthesia	T8859	Complications of anaesthesia, not elsewhere classified

Memorandum



TO	[Out of Scope]
CC	[Out of Scope]
VIA	[Out of Scope]
FROM	[Out of Scope]
FILE REFERENCE	
DATE	16 December 2020
SUBJECT	Claim Type Model Update

1. Recommendation

Approve the implementation of new Wilfully Self Inflicted (WSI) claim type model.

2. Issue

Recent work on WSI reporting has highlighted that some claims are not being correctly identified at registration by the current model.

3. Solution

Add the codes & words below to the WSI claim type model

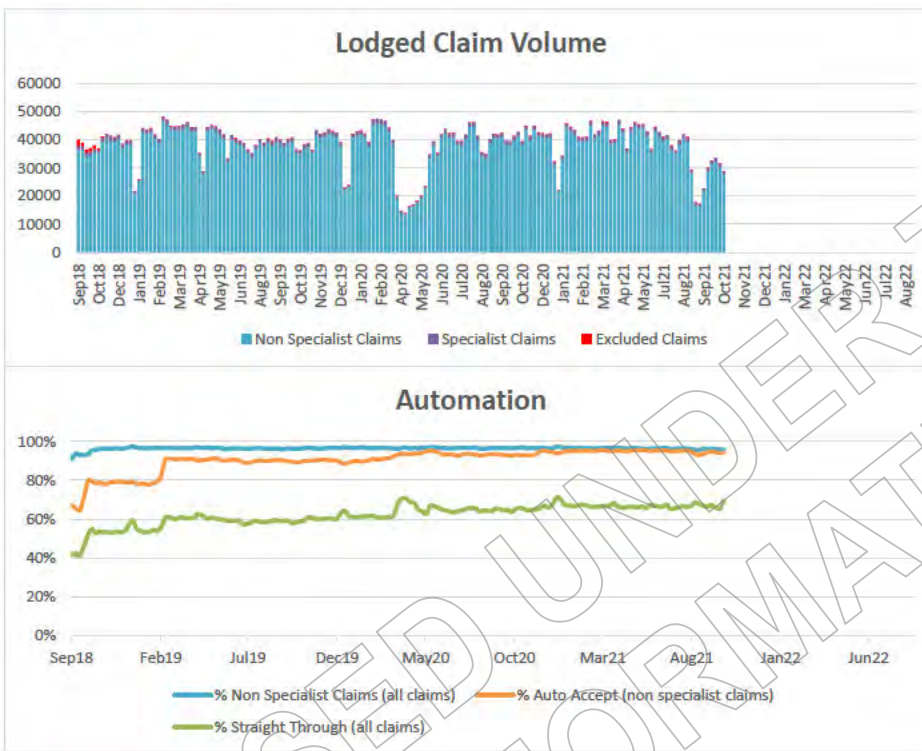
Code Type	Code	
READ	TK601	Self inflicted lacerations to wrist
READ	U41..	[X]Hanging strangulation + suffocation undetermined intent
READ	SM6..	Carbon monoxide causing toxic effect
READ	146A.	H/O: attempted suicide
READ	ZV1B2	[V] Personal history of self-harm
ICD10	R4581	Suicidal ideation

Word	Whole Word Flag
Intentional	Y
Attempted Hanging	
Suicide	
Deliberate	

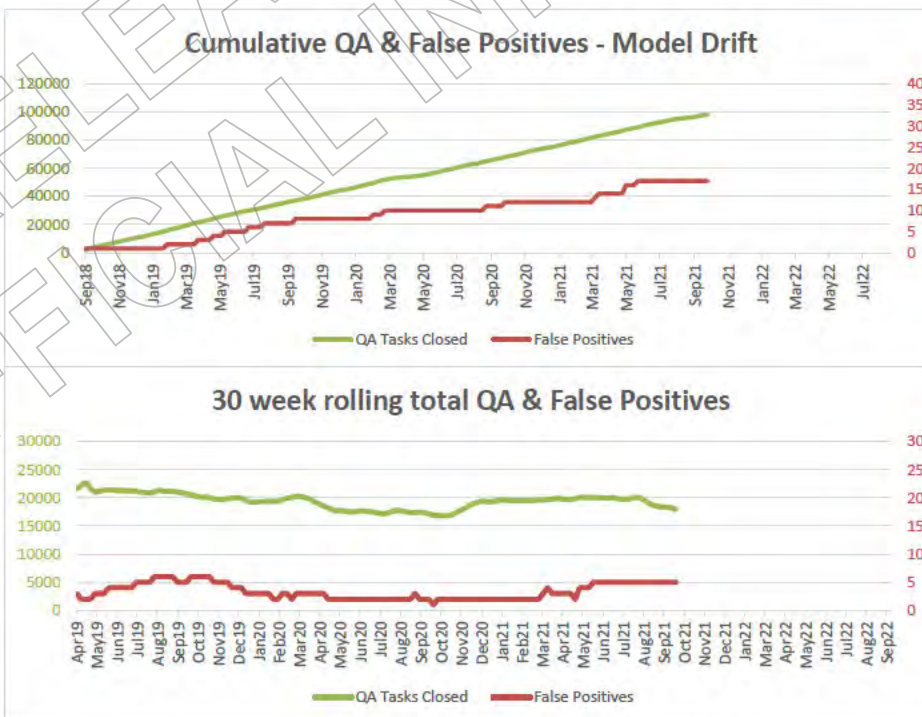
Note the whole word flag is required to avoid "Unintentional"

Based on rough testing (on the 2020 claims to date) these extra criteria would have resulted in an additional 1230 WSI identified, or approximately 25% more WSI claims streamed at registration. We would like to have the model run through the BXMS simulation to confirm these figures before it is implemented.

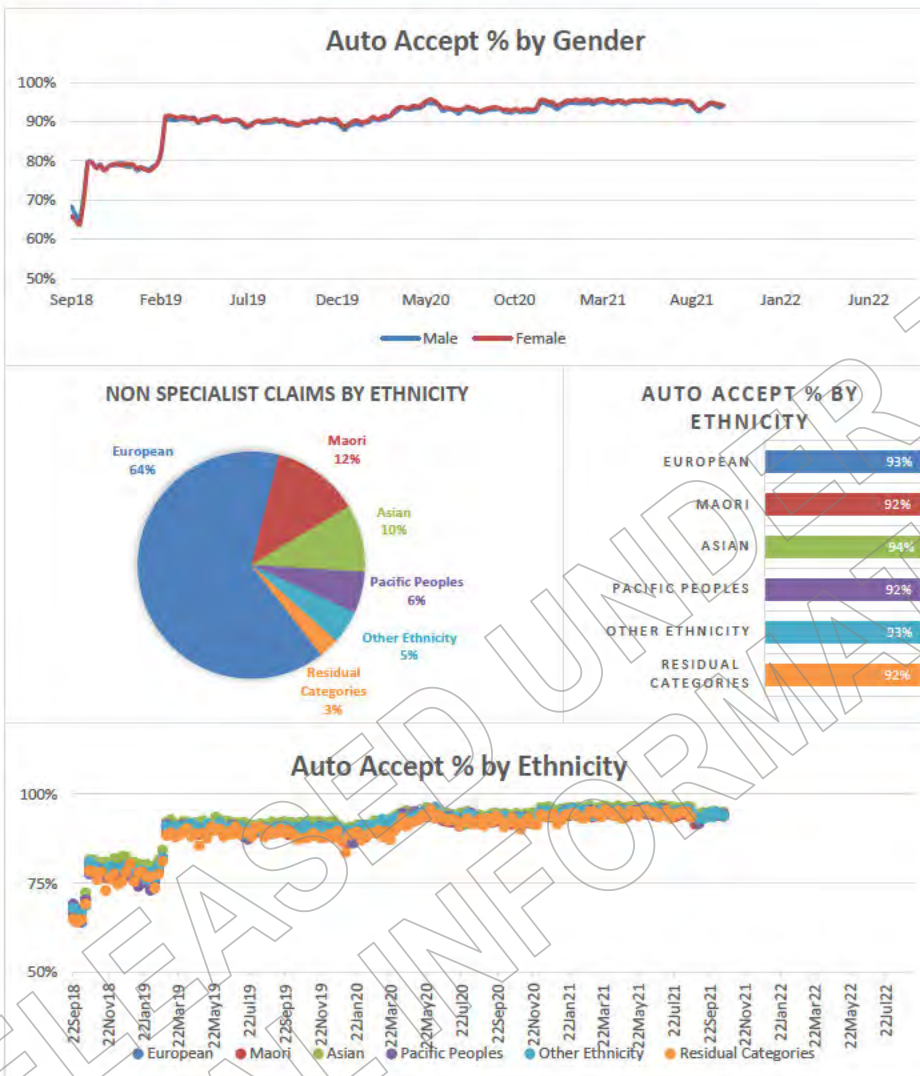
Efficiency



Accuracy



Demographics





He Kaupare. He Manaaki.
He Whakaora.
prevention. care. recovery.

Claim registration operational models

Model documentation v1.0 (April 2022)

Contents

Section 1 – Decision flow	3
Section 2 – Personal information used in modelling	5
Section 3 – Conversion probability models	9
Section 4 – Expected Claim Outcome (ECO).....	10
Section 5 – Engagement Model Decision (EMD).....	12
Section 6 – Business rules and threshold history	15
Appendix 1 – Cox proportional hazards.....	17

Section 1 – Decision flow

ACC's Next Generation Case Management (NGCM) is a key part of Shaping our Future strategy and will build upon the Transformation Programme and the ACC Health Services Strategy, with the following objectives:

- Achieve better client outcomes
- Improve customer experience
- Increase efficiency
- Improve employee engagement

To support these objectives ACC has invested in supporting infrastructure, statistical models and the development of business rules to inform:

- Client Front End Establishment/Lodgement
 - Automation of accepted cover decision for a majority of common injury profiles
 - Identification of claims held for manual cover decision assessment for the purpose of informing whether the nature of the injury is consistent with the Accident Compensation Act 2001
- Engagement Model Decision (EMD)/Triage Engine
 - Conversion probability models
 - Serious Injury probability model
 - Engagement Model Decision & Expected Claim Outcome

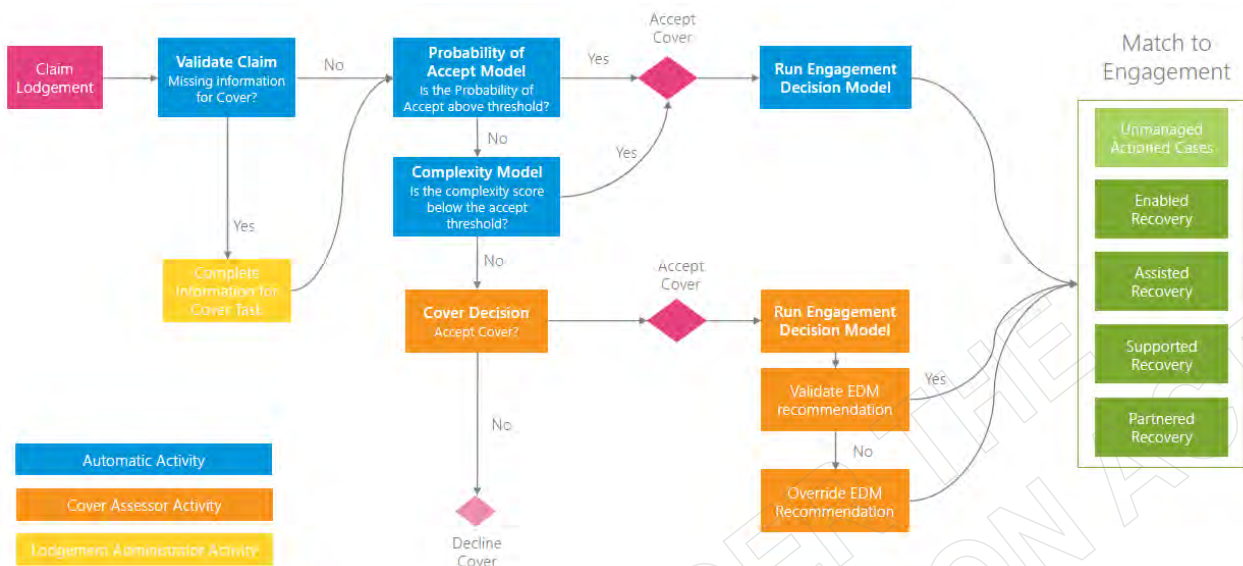
, NGCM has created different types of client engagement teams. These include:

- Enabled Recovery – offering clients the ability to self-manage their recovery
- Assisted Recovery – offering clients a mixture of self-management with ACC assistance (task based rather than one-to-one case management)
- Supported Recovery – offering clients with complex needs a dedicated ACC case owner
- Partnered Recovery – offering clients with specialist needs a dedicated ACC case owner

A conceptual representation of the initial flow of claims through the EMD Service into case management is depicted on the page below. The process flow operates as follows:

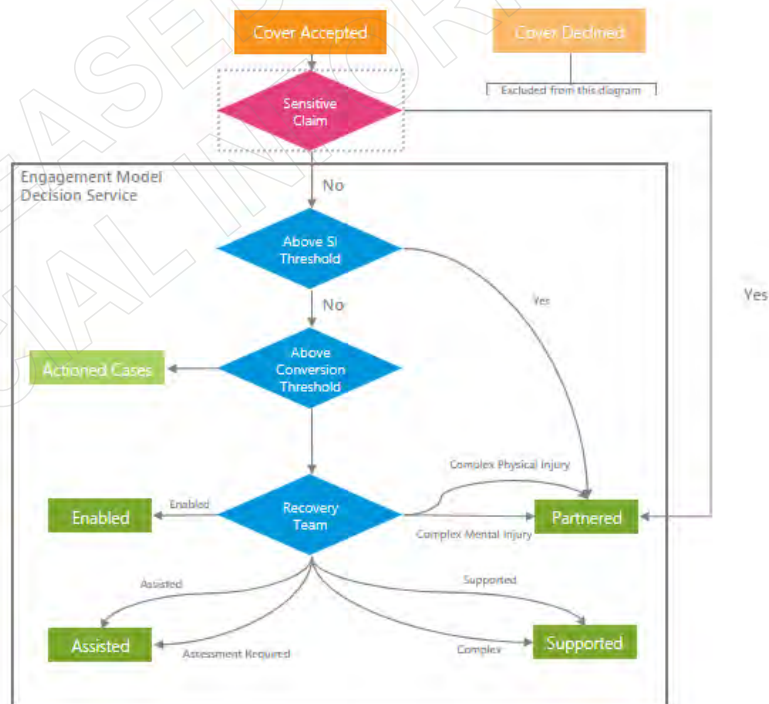
1. Sensitive Claims are excluded from the EMD. During the registration process, Sensitive Claims are allocated to Partnered where the cover decision is made. Accepted claims which were incorrectly matched to Partnered at registration (not a Sensitive Claim) will go through the EMD.
2. The EMD Calculations are run over claims prior to any allocation decisions. Information on the most suitable client engagement team etc. will be recorded against claims irrespective of initial allocations.
3. The Probability of Serious Injury is compared to the Serious Injury Threshold. If the Probability of Serious Injury is above the Serious Injury Threshold, claims are allocated to Partnered
4. The Conversion Probability is compared to the Conversion Threshold. If the Conversion Probability is above the Conversion Threshold, claims are allocated to a client engagement team. Otherwise, claims are allocated to Actioned Cases (unmanaged).
5. The remaining claims are allocated to client engagement teams. The matching of claims to client engagement teams is determined by a detailed sub process outlined in the EMD Thresholds Decision Paper. Claims that cannot be reliably matched to a client engagement team will be allocated to Assisted with the Assessment Required task for the Recovery Assistant to transition to the appropriate team.

Complete decision flow from claim lodgement to assignment to an engagement/recovery team:



Decision flow from cover acceptance to assignment to engagement/recovery team:

Note: The Serious Injury (SI) probability model is initially used to assess whether a claim has a serious complex injury that requires specialist engagement for clients with intensive and extensive needs.



Section 2 – Personal information used in operational modelling

Operational analytical models are the application of statistics, data, people and business processes to provide decisions and recommendations. The EMD service outlined in this document is intended to optimise the support that ACC provides to our clients, matching clients to the right engagement team as soon as practicable. Accordingly, the information collected, and the purposes for which the health information is collected, used and disclosed, will be largely unchanged. No new information is collected or stored by the project from incoming Provider data.

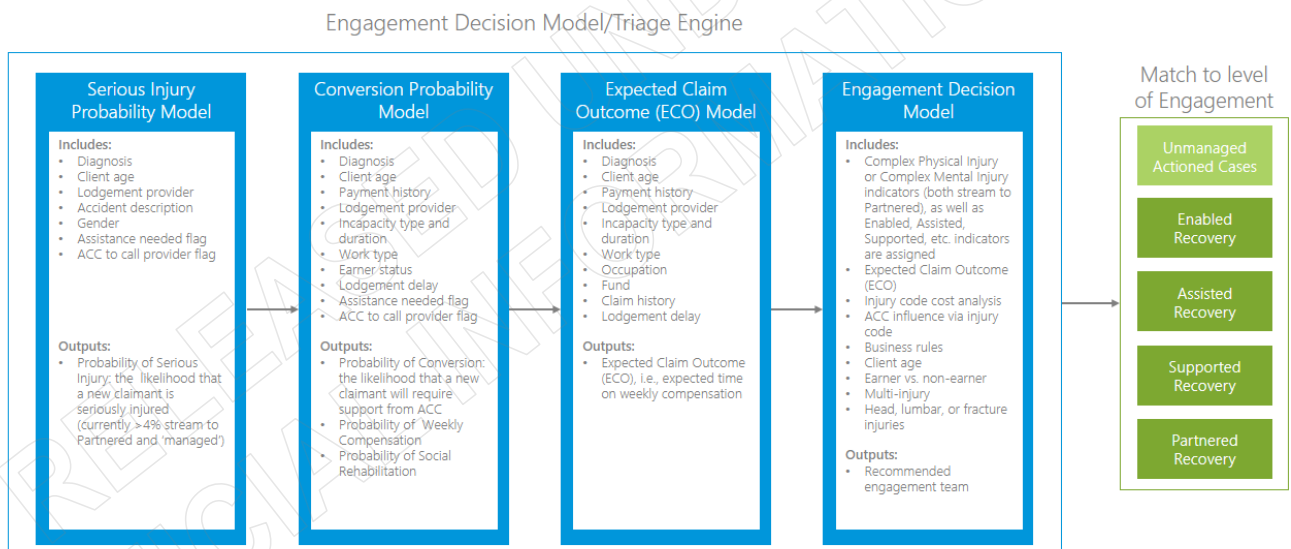
Type of health information	Source of information	Used by the following Models	Relevance to EMD Service
ACC To Call Provider Flag	ACC45 form	- Expected Time on Weekly Compensation Model - Probability of Weekly Compensation Model - Probability of Social Rehabilitation Model	<i>If yes,</i> - Expected Time on Weekly Compensation is higher - Probability of Weekly Compensation is higher - Probability of Social Rehabilitation is higher
Accident Date	ACC45 form	- Expected Time on Weekly Compensation Model - Probability of Weekly Compensation Model - Probability of Social Rehabilitation Model	<i>Delay between Accident Date and Lodgement Date,</i> - Expected Time on Weekly Compensation is higher or lower, depending on delay - Probability of Weekly Compensation is higher, if delay is higher - Probability of Social Rehabilitation Model is higher, if delay is higher <i>Time of day,</i> - Expected Time on Weekly Compensation is higher, if time of day is not specified
Accident Description	ACC45 form	- Expected Time on Weekly Compensation Model - Probability of Social Rehabilitation Model - Probability of Serious Injury Model	<i>Key words,</i> - Expected Time on Weekly Compensation is higher or lower, depending on key word groupings - Probability of Social Rehabilitation is higher or lower, depending on key word groupings - Probability of Serious Injury is higher or lower, depending on key word groupings
Assistance Needed Flag	ACC45 form	- Expected Time on Weekly Compensation Model - Probability of Weekly Compensation Model - Probability of Social Rehabilitation Model - Probability of Serious Injury Model	<i>If yes,</i> - Expected Time on Weekly Compensation is higher - Probability of Weekly Compensation is higher - Probability of Social Rehabilitation is higher - Probability of Serious Injury is higher
Claim History	ACC45 form	Expected Time on Weekly Compensation Model	<i>Number of previous claims with injuries on same body site,</i>

			- Expected time on weekly compensation is higher, if number is higher <i>If previous Sensitive Claim,</i> - Expected time on weekly compensation is higher
Client's Date of Birth	ACC45 form	- Expected Time on Weekly Compensation Model - Probability of Weekly Compensation Model - Probability of Social Rehabilitation Model - Probability of Serious Injury Model	<i>Age of client,</i> - Expected Time on Weekly Compensation is higher, if age is higher - Probability of Weekly compensation is higher or lower, depending on age - Probability of Social Rehabilitation is higher, if age is higher - Probability of Serious Injury is higher, if age is higher
Clinical Referrals	ACC45 form	Expected Time on Weekly Compensation Model	Expected Time on Weekly Compensation is higher or lower, depending on type(s) of clinical referrals, if applicable
Diagnosis Code (list)	ACC45 form and, if applicable, updates to Eos Claim File	- Expected Time on Weekly Compensation Model - Probability of Weekly Compensation Model - Probability of Social Rehabilitation Model - Probability of Serious Injury Model	- Expected Time on Weekly Compensation is higher or lower, depending on diagnosis code(s) and number of diagnosis codes - Probability of Weekly compensation is higher or lower, depending on diagnosis code(s) and number of diagnosis codes - Probability of Weekly compensation is higher or lower, depending on diagnosis code(s) and number of diagnosis codes
Diagnosis Body Side (list)	ACC45 form and, if applicable, updates to Eos Claim File	Probability of Social Rehabilitation Model	Probability of Social Rehabilitation is higher, if a specific diagnosis code is recorded for both body sides
Diagnosis Severity (list)	ACC45 form and, if applicable, updates to Eos Claim File	- Probability of Weekly Compensation Model - Probability of Social Rehabilitation Model	- Probability of Weekly Compensation is higher or lower, depending on injury severity - Probability of Social Rehabilitation is higher or lower, depending on injury severity
Earners Status	ACC45 form	Probability of Weekly Compensation Model	Probability of Weekly Compensation is higher or lower, depending on earner status
Fund Account	ACC45 form	- Expected Time on Weekly Compensation Model - Probability of Weekly Compensation Model	- Expected Time on Weekly Compensation is higher or lower, depending on fund account - Probability of Weekly Compensation is higher or lower, depending on earner status
Gender	ACC45 form	- Probability of Social Rehabilitation Model - Probability of Serious Injury Model	<i>If male,</i> - Probability of Social Rehabilitation is lower - Probability of Serious Injury is higher
Hospital Admission Flag	ACC45 form	Expected Time on Weekly Compensation Model	<i>If yes,</i> Expected Time on Weekly Compensation is higher

		• Probability of Weekly Compensation Model • Probability of Social Rehabilitation Model • Probability of Serious Injury Model	• Probability of Weekly Compensation is higher • Probability of Social Rehabilitation is higher • Probability of Serious Injury is higher
Incapacity	ACC45 form and, if applicable, ACC18 form	• Expected Time on Weekly Compensation Model • Probability of Weekly Compensation Model • Probability of Social Rehabilitation Model	• Expected Time on Weekly Compensation is higher or lower, depending on type of incapacity and period of incapacity • Probability of Weekly Compensation is higher or lower, depending on type of incapacity and period of incapacity • Probability of Social Rehabilitation is higher, if incapacity is specified
Lodgement Date	ACC45 form	• Expected Time on Weekly Compensation Model • Probability of Weekly Compensation Model • Probability of Social Rehabilitation Model	<i>Delay between Accident Date and Lodgement Date,</i> → See Accident Date above
Occupation	ACC45 form	• Expected Time on Weekly Compensation Model • Probability of Weekly Compensation Model	• Expected Time on Weekly Compensation is higher or lower, depending on occupation • Probability of Weekly Compensation is higher or lower, depending on occupation
Payment History	ACC historical invoice and payment records	• Expected Time on Weekly Compensation Model • Probability of Weekly Compensation Model • Probability of Social Rehabilitation Model	<i>Sum of payments on previous claims,</i> • Expected Time on Weekly Compensation is higher or lower, depending on sum <i>Time since last Vocational Independence,</i> • Expected Time on Weekly Compensation is lower, if time is higher <i>Number of previous claims with Weekly Compensation payments,</i> • Probability of Weekly Compensation is higher, if number is higher <i>Number of previous claims with Social Rehabilitation payments,</i> • Probability of Social Rehabilitation is higher, if number is higher
Provider	ACC45 form	• Expected Time on Weekly Compensation Model • Probability of Weekly Compensation Model • Probability of Social Rehabilitation Model • Probability of Serious Injury Model	• Expected Time on Weekly Compensation is higher or lower, depending on type of provider • Probability of Weekly Compensation is higher or lower, depending on type of provider • Probability of Social Rehabilitation is higher or lower, depending on provider

			Probability of Serious Injury is higher or lower, depending on provider
Work Accident Flag	ACC45 form	- Expected Time on Weekly Compensation Model - Probability of Weekly Compensation Model	<i>If yes,</i> - Expected Time on Weekly Compensation is lower - Probability of Weekly Compensation is higher
Work Type	ACC45 form	- Expected Time on Weekly Compensation Model - Probability of Weekly Compensation Model	- Expected Time on Weekly Compensation is higher or lower, depending on work type - Probability of Weekly Compensation is higher or lower, depending on work type - Probability of Social Rehabilitation is higher or lower, depending on work type

Simplified view of client information used by each operational model:



Section 3 – Conversion probability models

Three separate conversion probability models are used to initially determine the suitability of the claimant for case management. These are:

- Serious Injury probability model
- Earner conversion probability model
- Non-earner/social rehabilitation probability model

Serious Injury probability model

Initially after cover acceptance a claim is assessed whether it has a high probability or likelihood that the client's injury is high risk and requires significant involvement from ACC and/or a lifelong relationship due to the nature of their injury. Examples include tetraplegia, brain injury, amputations, burns, blindness, neurotoxicity, and spinal cord injuries. Claims with a high likelihood are directly assigned to partnered recovery for assessment and support. The serious injury probability model utilises logistic regression to predict the likelihood of serious injury using the following explanatory variables:

- ACC injury diagnosis read code, ICD9 and ICD10 diagnosis code (ACC45)
- Client age at claim lodgement (ACC45)
- Claim lodgement medical provider (ACC45)
- Accident description key words (ACC45)
- Gender (ACC45)
- Assistance needed flag (ACC45)
- ACC to call provider flag (ACC45)

Conversion probability models

Earner conversion probability model

Where an individual is employed in part time or full time work when an accident occurs ACC denotes the individual as having an earner status. For the purposes of determining case management ACC determines the probability of likelihood that the claimant requires weekly compensation within 28 days post claim lodgement.

Non-earner/social rehabilitation probability model

Where an individual is not employed in part time or full time work when an accident occurs ACC denotes the individual as having a non-earner status. For the purposes of determining case management ACC determines the probability of likelihood that the claimant requires social rehabilitation (e.g. attendant care, equipment, housing modifications, vehicle modifications etc) within the first six months following claim lodgement.

Both conversion probability models utilise logistic regression to predict the likelihood of each respective event. All explanatory variables used in the modelling process are outlined in Section 2.

Section 4 – Expected Claim Outcome (ECO)

Expected Claim Outcome (ECO) is ACC's operational statistical model which seeks to predict the duration (in weekly compensation days paid) for each claim lodged with ACC. This prediction informs how ACC initially assigns claims to recovery teams via the engagement model and how ACC staff prioritise workflow and decisions.

ECO was initially developed in 2012-13 for the purpose of informing case managers about the potential timeframes one could expect the claimant to return to work. Case managers cannot influence the rate claimants are being paid weekly compensation but they can influence the time they are being paid for. Weekly compensation costs have a significant influence on ACC's current and future Outstanding Claim Liability (OCL) and embedding a measure of duration into operational decision making is critical to managing ACC's future levy trajectory.

ECO is modelled using a statistical technique called Survival Analysis. At a point in time many weekly compensation claims that ACC manages have a variety of durations that can last several days or many years. Survival analysis is an appropriate modelling technique to use in this situation as linear regression (or similar technique) may underestimate the durations of claims by ignoring appropriate censoring.

Several survival analysis techniques are appropriate to model weekly compensation days paid. Cox proportional hazards ([Appendix 1](#)) was chosen for the following reasons:

- Successful application when understanding long-term ACC claims and in other jurisdictions/research contexts
- Common statistical technique across trained statisticians at ACC
- Proportional hazard assumption has been shown to be broadly satisfactory with ACC data
- Proportional hazards avoids the need to explicitly determine the form of the survival curve – this is modelled directly by the input data
- Proportional hazards also enables inclusion of time dependent covariates

Censoring

In order to use survival analysis a definition of open or closed/return to work has to be established. ACC has a standard definition of a closure/return to work in that a claim has not received any weekly compensation payments in the last 35 days. This definition is used for this model since it provides a reasonable measure of when a claim is closed and is consistent with other corporate key performance indicators at ACC.

Claims which last longer than 182 days are artificially censored at 182 days. This means they are flagged as open and have a duration of 182 days. This is to ensure the model focuses on shorter term claims and is tuned/calibrated to making an initial prediction.

Personal information

ACC receives a critical set of information on the ACC45 claim lodgement form. This informs many aspects about the claimant (e.g. contact details), the context of their accident and injury and any notes made by the health professional. As outlined in Section 2 ECO (referred to as the Expected time on weekly

compensation model) utilises many variables to estimate the potential length of time it takes for someone to return to work.

ACC maintains a record of individual service payments in accordance with commercial contracts with the Sector at a point in time. The ACC Scheme has undergone considerable change in its funding models over time, with many service contracts being bulk funded in the 1990s (e.g. elective surgery). The transition to a fee for service (pay as you go) funding model over time means ACC has a good record of service access since c.2001. For this reason this informed the decision to use a claimants past service history over the preceding 8 years into the original ECO model build. This has been retained in future years as a claimants service history over the preceding years has proven to be a good indicator of reinjury, client need and vulnerability.

Client Front End Establishment (CFEE) & Accident Description Service (ADS)

Where accident context variables are missing on the ACC45 form (e.g. prior activity) ACC has developed a series of models which seek to predict and update the classification. This is used to inform a cover decision and ECO.

Performance adjustment

One of the business aims from using ECO is to improve operational responsiveness, customer experience and improve return to work outcomes for New Zealanders. To encourage this the business decided to reduce predicted durations by 5%. This adjustment is embedded into all predicted outcomes and therefore flows into the engagement model decisions (i.e. assignment to a recovery team).

Section 5 – Engagement Model Decision (EMD)

The EMD Service runs on most claims once cover has been accepted for the purpose of identifying claims that require active case management, and the client engagement team they are most suited to. Where a claim doesn't have a pre-identified injury diagnosis code then the claim is manually assessed to ascertain the most appropriate level of case management and active support by ACC.

Information from a range of sources (ACC45, ADS service, data warehouses) initially flows into the EMD Service. Business rules and model predictions (e.g. ECO, conversion probability models) are then used to inform the best management action for the claim. This section will focus on how the EMD Service makes these identifications.

The EMD Service runs calculations and categorisations over claims prior to any allocation decisions and information on the most suitable client engagement team will be recorded on all claims received. Some of the calculations are fed into the Service from the case management system and data warehouses, and others are calculated within the Service itself.

The calculations and categorisations are:

- the Probability of Serious Injury, calculated by the Probability of Serious Injury Model;
- each of the diagnosis codes on the claims are assigned a categorisation, which were determined via clinical input and statistical methods;
- the Probability of Weekly Compensation (Earner/employed clients), calculated by the Probability of Weekly Compensation Model;
- the Expected Time on Weekly Compensation, calculated by the Expected Time on Weekly Compensation Model; and
- the Probability of Social Rehabilitation (Non-earner/non-work clients), calculated by the Probability of Social Rehabilitation Model.

Phase 1: Determination of initial case management

The client will be allocated to case management if:

- the most suitable client engagement team is identified as the Partnered Recovery engagement team;
- the Probability of Weekly Compensation (Earner/employed clients) for a given claim is above a predetermine threshold; or
- the Probability of Social Rehabilitation (non-earner/non-work clients) for a given claim is above a predetermined threshold .

If an accepted claim doesn't satisfy any of these conditions it is initially unmanaged until:

- Client engages with ACC to seek support (e.g. weekly compensation)
- Medical professional, on behalf of the client, engages with ACC

Phase 2: Determination of initial case management recovery team

The most suitable client engagement team will be identified as the **Partnered Recovery** engagement team if:

- the Probability of Serious Injury Model indicates the claim is likely to be for a Serious Injury;
- any of the diagnosis codes are categorised a complex physical diagnosis code; or
- any of the diagnosis codes are categorised a complex mental diagnosis code.

Otherwise, the most suitable client engagement team will be identified as the **Supported Recovery** engagement team if:

- any of the diagnosis codes are categorised as a Supported diagnosis code;
- the Expected Time on Weekly Compensation is in the high range;
- the number of diagnosis codes is in the high range, and the number of injury sites is high; or
- the number of diagnosis codes is in the high range, and claimant has a head injury.

Otherwise, the most suitable client engagement team will be identified as the **Assisted Recovery** engagement team if:

- any of the diagnosis codes are categorised as an Assisted Recovery diagnosis code;
- any of the diagnosis codes are not categorised, and if the claim is allocated to case management

the most suitable client engagement team will be assessed;

- the Expected Time on Weekly Compensation is in the medium range;
- the claimant is in the low age range; or
- the claimant is in the age high range, a non-earner, and has a specified injury.

Otherwise, the most suitable client engagement team will be identified as the **Enabled Recovery** engagement team.

Section 6 – Business rules and threshold history

Partnered recovery

[Allocation of new claim to partnered recovery](#)

A new claim must be allocated to **partnered recovery** if all of the following are true:

- The claim has been accepted for **cover**.
- The claim does not belong to a **client** with an **active claim** being managed in any of following units:
 - **Remote Claims Unit.**
 - **Wellington Central Branch.**
- The claim does not belong to a client who is an **ACC staff member**.
- The claim is not an **accredited employer claim**.
- At least one of the following is true:
 - The **probability of serious injury** calculated for the claim is greater than the **serious injury threshold**.
 - The claim is assigned a **sensitive complex claim type**.
 - At least one **diagnosis code** specified on the claim form submitted for the claim is any of the following:
 - A **complex mental diagnosis code**.
 - A **complex physical diagnosis code**.
 - All of the following are true for the claim:
 - The new claim belongs to a client with an active claim being managed in Partnered Recovery.
 - The **conversion probability** calculated for the claim is greater than the **conversion threshold**.

Supported recovery

[Allocation of new claim to supported recovery](#)

A new claim must be allocated to **supported recovery** if all of the following are true:

- The claim has been accepted for **cover**.
- The claim does not belong to a **client** with an **active claim** being managed in any of following teams:
 - **Remote Claims Unit.**
 - **Wellington Central Branch.**
 - **Partnered Recovery.**
- The claim does not belong to a client who is an **ACC staff member**.
- The **conversion probability** calculated for the claim is greater than the **conversion threshold**.
- None of the **diagnosis codes** specified on the **claim form** submitted for the new claim are any of the following **diagnosis codes**:
 - A **complex mental diagnosis code**.
 - A **complex physical diagnosis code**.
- The claim is not assigned a **sensitive complex claim type**.
- The **probability of serious injury** calculated for the claim is any of the following:
 - Equal to the **serious injury threshold**.
 - Less than the serious injury threshold.
- At least one of the following is true:
 - The claim is a **multiple severe claim**.
 - At least one diagnosis code specified on the claim form submitted for the new claim is any of the following types:
 - A **complex diagnosis code**.
 - A **supported diagnosis code**.
 - The **ECO score** calculated for the claim is greater than **ECO supported threshold**.
 - The new claim belongs to a **client** with an **active claim** being managed in any of the following by supported recovery.

Assisted recovery

A **new claim** must be allocated to **assisted recovery** if all of the following are true:

- The claim has been accepted for **cover**.
- The claim does not belong to a **client** with an **active claim** being managed in any of the following teams:
 - **Remote Claims Unit.**
 - **Wellington Central Branch.**
 - **Partnered Recovery.**
 - **Supported recovery.**
- The claim does not belong to a client who is an **ACC staff member**.
- The **conversion probability** calculated for the claim is greater than the **conversion threshold**.
- None of the **diagnosis codes** indicated on the **claim form** submitted for the new claim has any of the following **diagnosis code**:
 - A **complex mental diagnosis code**.
 - A **complex physical diagnosis code**.
 - A **Complex diagnosis code**.
 - A **Supported diagnosis code**.
- The claim is not assigned a **sensitive complex claim type**.
- The **probability of serious injury** calculated for the claim is any of the following:
 - Equal to the **serious injury threshold**.
 - Less than the **serious injury threshold**.
- The new claim is not a **multiple severe claim**.
- Any of the following is true:
 - The **ECO score** calculated for the claim is between the following **ECO scores**:
 - Greater than the **ECO assisted threshold**.
 - Equal to the **ECO supported threshold**.
 - The new claim belongs to a **client** whose age is less than **lower age threshold**.
 - The new claim belongs to a client with an **active claim** being managed in assisted recovery.
 - At least one diagnosis code indicated on the claim form submitted for the new claim is an **assisted diagnosis code**.
 - At least one of the diagnosis codes specified on the claim form submitted for the new claim is not any of the following diagnosis codes:
 - A complex mental diagnosis code.
 - A complex physical diagnosis code.
 - A Complex diagnosis code.
 - A Supported diagnosis code.
 - An assisted diagnosis code.
 - An **enabled diagnosis code**.
 - The claim belongs to a client of whom all of the following are true:
 - The age of the client is greater than the **upper age threshold**.
 - The client is a **non-earner**.
 - At least one of the diagnosis codes specified on the claim form is any of the following diagnosis codes:
 - A **lumbar injury diagnosis code**.
 - A **fracture injury diagnosis code**.
 - A **head injury diagnosis code**.

[Allocation of new claim to assisted recovery](#)

Enabled recovery

[Allocation of new claim to enabled recovery](#)

A new claim must be allocated to **enabled recovery** if all of the following are true:

- The claim has been accepted for **cover**.
- The claim does not belong to a **client** with an **active claim** being managed in any of the following teams:
 - Remote Claims Unit.
 - Wellington Central Branch.
 - Partnered Recovery.
 - Supported recovery.
 - Assisted recovery.
- The claim does not belong to a client who is an **ACC staff member**.
- The **conversion probability** calculated for the claim is greater than the **conversion threshold**.
- All of the **diagnosis codes** specified in the claim form submitted for the claim are an **enabled diagnosis code**.
- The claim is not assigned a **sensitive complex claim type**.
- The **probability of serious injury** calculated for the claim is any of the following:
 - Equal to the **serious injury threshold**.
 - Less than the serious injury threshold.
- The new claim is not a **multiple severe claim**.
- At least one of the following is true:
 - The **ECO score** calculated for the claim is less than the **ECO assisted threshold**.
 - The new claim does not belong to a **client** whose age is less than **lower age threshold**.
- The claim belongs to a client of whom at least one of the following is true:
 - The age of the client is any of the following:
 - Equal to the **upper age threshold**.
 - Less than the upper age threshold.
 - The client is an **earner**.
 - None of the diagnosis codes specified on the claim form is any of the following diagnosis codes:
 - A **lumbar injury diagnosis code**.
 - A **fracture injury diagnosis code**.
 - A **head injury diagnosis code**.

Thresholds

Earners conversion probability model:

- October 2020: 30%
- April 2021: 50%

Non-earner conversion probability/social rehabilitation model:

- October 2020: 30%
- April 2021: 90%

Engagement model

Partnered recovery: Serious injury threshold 4%

Supported recovery: Expected Claim Outcome Optimum/Median 120+

Assisted recovery:

Expected Claim Outcome Optimum/Median 35+

Lower age threshold: 18

Enabled recovery: Upper age threshold: 60

Appendix 1 – Cox proportional hazards

The **Cox proportional-hazards model** is a regression model commonly used statistical in medical research for investigating the association between the survival time of an observation and one or more predictor variables.

Resources:

https://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_survival/BS704_Survival6.html

https://www.statsdirect.com/help/survival_analysis/cox_regression.htm