EXTERNAL PEER REVIEW

Interim findings on the feasibility of using predictive risk modelling to identify new-born children who are at high risk of future maltreatment
(April 2013)
Companion Technical Report
(April 2013)

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CONTENTS

Contents 2
1. Background 3
1.1 Overview 3
1.2 Preliminary Comments 3
1.3 Background context 3
1.4 *Interim Findings* Report – Clarity of Purpose and Positioning of Māori Issues and Analysis 5
1.5 Literature review 6
1.6 Comparison with other tools 6
2. Review of Feasibility Study and Interim findings 7
2.1 Data Linkage and Data 7
2.2 Ethnicity Data 7
2.3 PRM development and feasibility testing 8
3. Implications for Application 12
4. Conclusions 13
4.1 Strengths and Limitations 13
4.2 Recommendations 14
4.3 Overall Conclusions 15

1. BACKGROUND

1.1 OVERVIEW

This review has been undertaken in response to a request from the MSD for peer review of the *Interim findings on the feasibility of using predictive risk modelling to identify new-born children who are at high risk of future maltreatment.*[1] *(April 2013)* and the accompanying *Companion technical report*[2] *(April 2013)*.

MSD requested that: *"the Provider will draw on the knowledge and skills of a Māori epidemiologist to provide a culturally informed appraisal of the study, and its methods, use of data, findings, interpretation and potential application."*

The review is in four sections: (i) Background (ii) PRM development and feasibility testing, (iii) Implications for Application (iv) Conclusions

1.2 PRELIMINARY COMMENTS

The over-representation of Māori children among those who have substantiated child maltreatment reinforces the importance of child maltreatment as an area of priority for Māori. This over-representation sits alongside other ethnic inequalities evident within NZ that impact particularly on children including health, justice, education, housing, employment and economic inequalities. There is clearly a need to continue striving for greater understanding of the drivers of ethnic inequalities in child maltreatment and the development of effective approaches to reducing child harm.

This *Interim Findings* report has been challenging to review. There are many technical and analytic steps involved in the research, each with its own set of considerations, many with particular issues relevant to a Māori analysis. In addition the novel nature of the use of PRM tools in predicting child maltreatment means there is little similar work on which to consider this against.

Finally, it has also been challenging to fully explore and identify the broader issues in relation to application of PRM in practice. In particular the potential for harm in 'getting it wrong' is high. A need to avoid risk and harm sits against the importance and seriousness of the need to support child wellbeing.

1.3 BACKGROUND CONTEXT

In undertaking this review, I have centred analysis on Māori and thus focussed particularly on gaps and omissions, areas of uncertainty or challenge in relation to findings for Māori.

Background literature was reviewed to provide a context for this review and included:

- Vulnerable Children: Can administrative data be used to identify children at risk of adverse outcomes (September 2012)[3]
- The White Paper for Vulnerable Children Volume II (2012)[4]
- A number of other references associated with the interim report and technical report.

[1] Referred to as the Interim findings report from this point onwards.
[2] Referred to as the Technical report from this point onwards
[3] Vaithianathan et al, 2012, Centre for Applied Research in Economics (CARE) Department of Economics, University of Auckland
[4] New Zealand Government

WHITE PAPER FOR VULNERABLE CHILDREN (2012)

The *Interim findings* study is positioned in relation to the New Zealand Government's 2012 White Paper for Vulnerable Children. The White Paper signals a focus on increased information relating to vulnerable children to be shared across sectors and for use of this information as a foundation for decision making when predicting needs of vulnerable children. The White Paper further signalled a set of new intervention initiatives including a service of Children's Visitors for vulnerable children.

The *Interim Findings* research aligns with the proposal within the White Paper for using predictive risk modelling (PRM) tools to assist in identifying children at risk and also to support early intervention strategies. The researchers also identify that the PRM tool could be part of the process of identification of children who would be a priority for being seen by Children's visitors, alongside other aspects of assessment.

Within the White Paper the importance of addressing the needs of vulnerable Māori children and of services that are effective for Māori is mentioned. Current initiatives such as Whānau Ora are also outlined in the White Paper and it is recognised that approaches to addressing the needs of vulnerable Māori children will require careful consideration within the context of ensuring effective prevention approaches and service delivery for Māori.

AUCKLAND UNIVERSITY STUDY (2012)

The use of PRM was investigated by a University of Auckland team who concluded the use of a PRM tool for predicting children at increased risk of child maltreatment was promising. The Auckland University report (Vaithianathan et al 2012) focuses specifically on children who have had 'spells' on a benefit before they reach the age of two.

A core algorithm made up of a range of predictive factors was used to predict children who experienced substantiated maltreatment by age 5. The Auckland researchers chose a 'dynamic approach' and thus rescored children each time they entered the benefit data. Predictor variables included subject child factors (care and protection history), other children factors (care and protection history of other children in family), caregiver characteristics (gender, age, and qualifications), family characteristic (number of caregivers, number and age of other children etc); caregivers own care and protection / benefit history[5]. 224 variables were initially included in the model, from this non-significant variables were dropped using stepwise probit regression. This step led to 132 variables in the core algorithm.

The researchers from this study found their core algorithm to perform "fair, approaching good" in terms of predictive power with an ROC of 76%. They go on to use their findings to determine sensitivity of their measure and a "numbers needed to treat analysis". In this analysis, they calculate how many children at the greatest risk (according to their model) would need to participate in an effective intervention in order to prevent episodes of maltreatment. The authors further provide an economic analysis, literature review and recommend very strongly for ethical review across a number of domains.

MĀORI FINDINGS FROM THE AUCKLAND STUDY

Within the Auckland University document there is a lack of analysis related to Māori aspects of the research. There is no commentary on how ethnicity is considered within the predictive model and no opportunity to identify if the performance of the model in terms of predictive power, sensitivity or specificity was as effective for Māori and non-Māori. In the description of potential ethical issues to be explored there is no mention of particular ethical issues in relation to Māori. It is uncertain as to whether these were not included in the analysis because they were not considered important or whether they have not been included in the written report however were included in analyses. Within the Interim Findings report it is highlighted that the

[5] Of note, ethnicity is not described as a factor that is considered in the analysis within the Auckland report

Auckland Study had established that there was no need to include ethnicity in the prediction model however it is difficult, in the published report to find this analysis.

1.4 *Interim Findings* Report – Clarity of Purpose and Positioning of Māori Issues and Analysis

Stated purpose

The purpose of the *Interim Findings* report is to *"present interim findings from a study that examines the feasibility of a predictive risk modelling (PRM) tool that would automatically identify new-born children who are at high-risk of future maltreatment.".* The researchers strongly align this research with the White Paper proposal for PRM tools *"to assist professionals in identifying which children are at risk of abuse or neglect to support a preventive early intervention strategy, subject to the outcomes of feasibility study and trialling"* (p1 Interim Findings). Thus the aim is a tool that can ultimately be used in practice with children and families.

Both the Interim Findings and Technical reports describe a range of issues associated with work recently undertaken by the MSD developing and testing a PRM tool (founded on the Auckland study) with a view to further development and refinement prior to possible application in the near future. The expectation is that the PRM tools would help identify which children met the relevant threshold for intervention support from a local Children's Team.

Other work alongside this is outlined including: ethical review, qualitative research with front-line staff and the development of an evaluation strategy.

Purpose / Approach with regards to Māori data and analyses within the feasibility study

Despite there being a stated purpose for this study i.e. to develop and test the feasibility of a tool for prediction of potential child maltreatment, the report does not specify a purpose in relation to exploring the feasibility for Māori children specifically. Within the body of the report selected analyses testing the effectiveness of the PRM model for Māori are presented and data tables include some presentation of findings by ethnicity and when comparing Māori with non-Māori.

Māori children make up the majority of children identified within the research as being at risk of maltreatment and questions / objectives to ensure the PRM tool is appropriate, safe and performs well for Māori are clearly crucial. However in reviewing the report, only some of the analyses are presented for Māori and others that would clearly be important to understand with regards to Māori findings are not shown.

An example of an essential analysis for understanding the performance of the model in relation to Māori is that shown in Table 2 (p 16 Interim Findings report). This table shows findings for the accuracy of prediction at different thresholds and the counts for false positives. It provides the most important data related to Positive predictive value (PPV), Negative predictive value (NPV) and sensitivity analysis associated with the scores indicating "high priority". The associated points in the report (points 64 to 80) provide the researchers' interpretation of whether this PRM tool is feasible and appropriate to use as a predictive tool. The researchers focus in a later section on *"whether the representation of Māori children among those who might be referred by a PRM is proportionate to their share of the population of children known to be maltreated" (point 93, page 23 Interim Findings report).* Although also important as an analysis, it does not provide the detail of understanding of how well the model works and the range of information provided in Table 2.

It is strongly recommended that gaps in the feasibility study with regards to analysis and presentation of findings in relation to Māori are addressed in the next phase (see conclusions).

1.5 LITERATURE REVIEW

The researchers recognise the difficulties identified within the literature in relation to making predictions of child maltreatment. Challenges include lack of standardised assessments, risk of high false positives, risks of harm associated with labelling parents as potential abusers, risk of stigma. In addition the researchers highlight little previous research using 'advanced computational tools' to support decision making in child protection. It is highlighted that the use of PRM tools are most advanced in healthcare. The Auckland study was the first to examine PRM tools using existing administrative data for early detection of child maltreatment and has been built on for the feasibility study.

Given the new and novel nature of this PRM tool development and testing, it would be useful to identify what can be learnt about the use of predictive tools in Māori from within the health sector as this may shed light on issues that arise including how best to deal with differing patterns of risk factors / risk markers among Māori when compared with non-Māori. The issue of whether separate models should be considered for Māori and non-Māori is raised within the Interim Findings report and literature review of health related predictive models which face similar issues would be of interest.

1.6 COMPARISON WITH OTHER TOOLS

The researchers conclude that "*Compared to other tools developed to predict the risk of future maltreatment for new-born children, these models perform well and are feasible to implement.*"

Based on the information provided in the Interim Findings report, I was unable to see a detailed comparison with other tools. In particular, a comparison with a cumulative risk approach to identifying risk would be useful to consider. The availability of a linked data-set provides a range of information that could be incorporated into a model that quantifies and scores cumulative risk. It would be useful to see how this would compare with the PRM model based on stepwise logistic regression.

2. REVIEW OF FEASIBILITY STUDY AND INTERIM FINDINGS

2.1 DATA LINKAGE AND DATA

The data provided as part of data linkage brings together data from across sources. The approach to linking data and the use of a conservative approach to reduce false positive linkage is appropriate.

The linkage process, construction of the cohorts and data related to predictors and outcomes is a significant piece of work and the researchers have described well the rationale for data sources and the choice of birth cohorts to use as part of the analysis. There are clear descriptions of the differing data sources and the birth cohorts. This level of robustness is necessary and I was unsure how the quality control challenges would be met when calculating a PRM score for new-born children as part of implementation.

One area for inclusion is an explanation of ethnicity in relation to differing data sources and to data-linkage. The commentary associated with Table 4 states that ethnicity is taken from birth registrations. It is unclear for analyses that are taken from non-birth registration data sources, if there is additional recording of ethnicity or whether linkage to birth records will be required in order to determine ethnicity. Also, for models that do not include birth data, it is unclear how ethnicity is identified and analysed within these models. It is noted that the only analyses available presenting Māori / non-Māori models is 3c where all data sources are included – how would ethnicity data from care and protection sources only be defined?

The data linkage and the development of cohorts where outcomes can be examined, in itself provides a very useful platform for gaining understanding about factors associated with later maltreatment. It would be useful for the MSD to undertake further analysis of this data, to gain greater understanding of issues associated with maltreatment and explore ethnic inequalities. An example of this is in Tables 2 and 3 of the Technical Report. These tables provide valuable information about a range of important background factors and the relationship with later outcomes. They also highlight areas of inequality and differences in patterning of risk and outcome comparing Māori and non-Māori.

A distinct analysis of this data, exploring the nature and issues associated with ethnic inequalities might shed further light also on why the model acts differently for differing ethnic groups. Furthermore, it would be useful to consider how increased background analysis might influence the development of separate predictor models for Māori and non-Māori.

2.2 ETHNICITY DATA

Within the reports (both the Interim findings report of the Technical report) there is a lack of clarity about how Māori ethnicity is defined and determined.

As a footnote to Table 4 (page 24) some information is provided with regards to data presented in Table 4.

"Children can have more than one ethnic group recorded. Ethnic groups are as recorded on the birth registration. Ethnicity data is missing for children included in benefit by three months of age for whom there is no linked birth registration data...."

The data in Table 4 (p 24 Interim findings) thus presents a 'total response' picture for findings for maltreatment by ethnicity for all children, children with findings by age 2, children with the top 3% of scores and top 5% or scores. This table reflects the likelihood of children having multiple ethnicities and the % for each group of findings by ethnicity is >100.

Table 4 shows that Māori children made up 28.2% of all children, 62.1% of the children with maltreatment findings by age 2, 69.3% of children in the top 3% of PRM scores and 68.0% of children with the top 5% of

scores. Overall the table showed that those children who are European (using a total response measure) have greater consistency between findings by age 2 (52.8%), top 3% or scores (52.0%) or top 5% of scores (52.1%). It is likely that there are some Māori ethnic group children who are also included within the European ethnic group findings as part of this analysis (due to multiple ethnic identifications). It is difficult to understand the implications of this for interpretation of data reporting how well the PRM tool performs in relation to Māori and non-Māori (given that non-Māori is not reflected in Table 4.)

There appears to be no other descriptor of ethnicity or how it is defined and thus, when reviewing the Technical Report (Tables 2 and 3), data (presented for Māori and for non-Māori) it is unclear how best to interpret this data without making assumptions. I have assumed that Māori / non-Māori analyses use prioritised ethnicity with Māori being all those who self-identified as Māori and non-Māori, all those who did not identify as Māori[6]. This is also an assumption made when interpreting commentary associated with the relative performance of the PRM model for Māori when compared with non-Māori.

It would be helpful for more information to be provided about ethnicity as a variable within the reports (both findings and technical). This information is required in order to make sense of the analyses and also the interpretation of the analyses related to ethnic differences and to Māori non-Māori differences. Given that there is an aim of increasing the range of data sources to potentially also include health data, and then clarifying the approach to dealing with ethnicity in differing data sources is important. Table 4 is an important table and it would be useful to see the findings presented not just for 'total response' however also for prioritised ethnicity. It would be useful to see consideration of the strengths and weaknesses of using total response or prioritised ethnicity for differing analyses.

Point 49 (page 12 IF report) states "*Vaithianan et al (2012) established that ethnic group does not need to be included as a predictor in order to support PRM, adding only marginally to the model. This was confirmed in preliminary* analysis." I was unable to find the section in the Vaithianan report that presented this data and it is mentioned however not presented within the Interim Findings report.

2.3 PRM DEVELOPMENT AND FEASIBILITY TESTING

This section discusses a range of issues that were identified as part of the peer review in relation to the PRM development and feasibility testing. The below focuses particularly on issues of particular relevance for Māori and it is not a review of the overall development or feasibility from a general population perspective however a number of more general issues are identified[7].

TERMINOLOGY

Risk markers, risk factors and predictor variables: The development of the model involves identifying predictors and including them in a model. It is reinforced within the report that the predictors themselves are not being seen as causal risk factors but rather potential markers for risk within the context of a model. It would be useful to outline these definitions in future reports as there are instances where variables are called risk factors as part of the model development however caution is also taken to ensure there aren't causal interpretations made. It may be useful to use the term risk marker to reinforce that the aim of the tool is not to prove what causes maltreatment. This may also reduce the risk of misinterpretation that the model is identifying predictors or risk factors that are 'causing' the abuse.

Māori / Non-Māori: Aligned with the discussion related to ethnicity data, it would be good to ensure that the various tables presenting findings by ethnicity clearly identify whether this is based on total response or prioritised ethnicity and the source of the ethnicity data.

[6] I have assumed also that those people who identified as Māori alongside another ethnic group (e.g. European) would not be included in the Non-Māori group for the Māori / non-Māori analysis.

[7] Comments are made in a range of detail with some areas having very brief comments only.

Maltreatment and outcome: Within this report, the definition of what is maltreatment is based on a substantiated finding of maltreatment based on recognised definitions within care and protection data. I am less familiar with this data however the PRM model would suggest that the outcomes associated with care and protection are all 'maltreatment' related. I am unsure about how involvement of care and protection staff for constructive reasons (e.g. at the request of parents / whanau for support at times of difficulty) would be considered as an outcome. It would useful to have more information about what is inclusion and exclusion in relation to this outcome data. If health data is also included it is uncertain if this becomes part of the 'outcome' identification or whether it becomes a predictor. Clarity with regards to this is needed.

Development and Feasibility of the PRM model

Study population

A number of study populations have been created on which to develop the PRM tool and test its feasibility. Challenges associated with birth registration and timing associated with completeness of data are well described. A specific base model for Māori children has been created for Māori children in birth cohort 2010 using data sourced across all sources however no specific Māori model is shown for 1c or 2c linkages.

Predictor Variables

The researchers describe the range of predictors used within the model, sourced from administrative data using a similar set of recognised factors associated with child maltreatment. A number of new potential sources are identified for the next steps of feasibility testing including health and injury data.

Continuous variables have been converted to categorical. This seems appropriate for this process however it would be useful to explore categories chosen further, including their implications for understanding the model. An example is deprivation decile. It may be useful to consider separating out the 'most deprived deciles' e.g. consider the possibility of deciles 8 and 9, then decile 10 separately.

One predictor variable I have been uncertain about is "Benefit type". I tried to gain a greater understanding of the relationship between benefit type and maltreatment outcomes by looking more closely at the data in Table 3 Companion technical report. It would be useful to discuss more fully in the report how "Benefit type" is considered within the regression analysis. In the tables (a) to (g) in Appendix 4 it shows an Odds ratio for each benefit type vs. No Benefit however not in relation to each other. Thus, it seems to be a "benefit vs. non-benefit" analysis. It would be useful to see more detail provided on this as Benefit Type is such a key variable. It is noted that Benefit type becomes much less important for the 1c model and is not present on the 2c model (p30 companion report).

One issue for consideration are protective factors. Although the model encompasses risk markers, it would be helpful to identify if there are other factors that may be available in administrative data that may enhance the model with regards to Māori. These may include access to extended whānau support, access to early childhood education / Kohanga reo etc.

Other factors that may reflect family stress include household composition and overcrowding and equivalised household income. The researchers suggest creating a combined measure of parental stress however focus on the number and age of other children in this measure. It would be useful to consider poverty and housing related stress also as part of any measure of parental stress.

It is useful also to see the potential inclusion of other environmental factors – again there may be potential to include for example access to services (e.g. density of childcare and primary care services, presence of Māori health provider services etc).

Overall it was surprising to see very little recognition of housing or socioeconomic related predictors given the relationship between poverty and child abuse. Deprivation is included however termed a community factor. It

would be useful to see if administrative data relating to housing, overcrowding, equivalised household income or some measures of childhood poverty could be included in the model.

Development of the Model

A stepwise logistic regression model is used in the development of the PRM tool. The Technical Report provides a detailed account of the datasets used, how the data is partitioned and how the model is tested. The focus on base models developed for the 2010 birth cohort and then tested on the 2007 cohort appears appropriate.

Point 47 re model choice (p 12 Technical report: *"Stepwise logistic regression was selected for the study as a modelling strategy that has good predictive performance, can be easily explained to stakeholders, and is straightforward to implement."*

The use of stepwise logistic regression models for predictive modeling has been criticized and not recommended by some (Flom and Cassell, Hassell). It would be useful to see the researchers' rationale for choosing stepwise regression to also include an analysis of how these recognised criticisms of stepwise regression have been considered in the development of this model.

The PRM tool and Māori

A specific base model for Māori children has been created for Māori children in birth cohort 2010 using data sourced across all sources however no specific Māori model is shown for 1c or 2c linkages.

In the Interim findings report, researchers found the model would lead to an over-representation among Māori children referred (68% if the top 5% scoring in the PRM model was used) compared to known rates (62% maltreated by age 2). There are ethical issues associated with a model that performs less well for Māori when compared with non-Māori (including the increased misclassification). This will need to be addressed (alongside other issues) if the tool is to be able to be considered appropriate for use.

The researchers have also recognised this is an issue that requires further research. In addition to this over-representation, the researchers also have found that the models developed for Māori and non-Māori have different main predictors suggesting "different risk and protective factors may be at play for each". The researchers have recognised the need to further explore the data and model to understand this finding and to find ways to address this issue. The importance of understanding the baseline data in relation to before entering into a regression model is important. If the relationship between the predictor variables and the outcome is not well understood in the first place, then it leads to difficulty in understanding how to make sense of how the variable operates within the model. There is a risk that a poor understanding of how this kind of model works, will influence interpretation of what it means for a variable to end up being included within the model or not.

In the absence of previous research related to use of administrative tools to predict risk of child maltreatment, it would be of benefit to review how New Zealand approaches to standardised risk assessment in health (e.g. cardiovascular risk assessment tools) have taken into account Māori within their risk assessment tool development. The issue of whether to have a 'one size fits all' tool or one specifically tailored to risk assessment among Māori, will likely have been considered as part of some of health related prediction tools within the NZ health setting.

Further Research

The researchers have recognised the need for more research related to the model and Māori, in addition to opportunities to learn more about issues such as bias and their suggestions of further investigation include:

- Investigation of differences in risk and protective factors between Māori and non-Māori

- Investigation of "whether the high representation of Māori children in the care and protection system is disproportionate to their underlying rate of maltreatment" (p5, Interim Findings report).
- Investigation of the potential to use separate models for Māori and non-Māori including the feasibility of the approach and its implications.

The researchers outline a range of areas (see following) related to data and analyses including exploring issues for Māori associated with the feasibility of the PRM tool. It seems very important that issues, questions, concerns and limitations associated with the implementation of the PRM tool are well understood and addressed before more broad application is undertaken among Māori whānau.

I am more familiar with risk prediction models in health (e.g. in heart disease) where cardiovascular risk assessment is now routine within a health service setting with a current campaign to encourage Māori men to get checked. The advantage in the development of these risk prediction models for heart disease is that there has been a wide range of research underpinning the science of the development of specific cardiovascular risks. Within Cardiovascular guidelines in NZ the epidemiology of cardiovascular disease is also recognised as an important aspect of the application of risk models. Careful consideration has been taken of ethnic differences and how those differences can be incorporated in the development and delivery of risk prediction tools. This has lead to a recommendation of application of screening tools 10 years earlier among Māori and Pacific people. This provides an example of the importance of having a clear understanding of the particular outcome (in this case cardiovascular disease) in relation to Māori, and ensuring the model thus takes this difference into account.

Differences for Māori and non-Māori

Throughout the Interim Findings report and the Technical Report, where Māori are mentioned, it is clear that there are a range of issues that may be operating differently for Māori compared with non-Māori. It seems very important that ethnic differences are considered and recognised as part of model development and testing. In point 156 (p 38 IF report) the researchers highlight the opportunity for undertaking new analyses with an aim to better understand Māori children's experiences of maltreatment and disproportionate representation.

In addition to this, the decision as to whether a Māori specific model should be considered. If a decision is made that there must be a "one-size-fits-all" model, then at a minimum, the implications for this by ethnicity is essential. Thus, measures such as those shown in Table 2 (IF) need to be clear for Māori, Pacific etc.

Some other Issues

The following are a number of other brief points identified in the review:

- Page 4 *"Preliminary research established that ethnic group does not need to be included as a predictor in order to support PRM, adding only marginally to the model."* I was unable to find the source of this preliminary research.

3. IMPLICATIONS FOR APPLICATION

There are clearly many issues to consider in the application of the PRM tool for Māori. Initially foundational issues in the effectiveness and appropriateness of the tool for Māori must be addressed before considering application. There is insufficient information specific to Māori as yet, provided in this feasibility study to feel confident in considering application at this point. If implemented without a very good understanding of the appropriateness and robustness of the model in relation to Māori, then it will be difficult to reassure individuals, communities and stakeholders of the effectiveness of the model in informing about risk or justifying the use of an intervention.

One issue to consider is the potential for unintended consequences. There are potential risks also of increasing stigma and discrimination towards young Māori families, profiling them as increased risk of maltreating their children if the model and process for use is not well understood and carefully communicated. Poor communication or understanding of the model and its use may potentially be accentuate current negative views of young Māori parents, particularly if the many issues associated with ensuring robustness for Māori, are not addressed. It is crucial that the implementation of the PRM tool does not inflame this kind of negativity towards Māori whānau. It is important that this potential for harm is considered within ethical review.

Given the over-representation of Māori within these statistics then any model developed will need to have been carefully considered, in order not to increase stigma or accentuate any bias to assuming Māori are likely to be abusers, related to the tool and its application.

4. CONCLUSIONS

4.1 STRENGTHS AND LIMITATIONS

The importance of tackling the unacceptable rates of child maltreatment and the over-representation of Māori children within child-maltreatment is very clear and undisputable.

This peer review has involved review of two reports: *Interim findings on the feasibility of using predictive modelling to identify new-born children who are at high risk of future maltreatment (April 2013) and the Companion Technical Report.* These reports reflect a significant body of work, aiming to use administrative data to develop a tool that can ultimately used to better predict risk of future child-maltreatment among newborn babies in New Zealand. My peer review has focussed on issues raised in considering the feasibility study from a Māori perspective.

Strengths: From this perspective the strengths of the research include:

- An important and significant body of research has been undertaken that investigates the feasibility of a potentially important tool supporting child maltreatment prevention.
- The development of a new database of linked data has allowed for an unprecedented opportunity to identify to follow cohorts of new-born babies (Māori and non-Māori) and identify which factors have been associated with later substantiated maltreatment.
- The researchers have taken care to ensure data quality and completeness and addressed many quality control issues in the research overall very thoroughly and this provides a robust database on which to undertaken analyses
- A range of predictors are included in the model and limitations are described for some of these predictors. There is a desire to continue to potentially enhance the range of predictors.
- The researchers have described well their decision-making about the model development and testing
- The researchers have recognised the importance of exploring the model in relation to Māori and presented some findings. These findings include: presentation of a predictive model applied to a cohort of Māori babies, and recognition that using the PRM model tested for the feasibility study, that Māori over-representation is amplified.
- The researchers have recognised that there is a need for more research in order to understand better issues related to maltreatment and Māori, and also a number of considerations in relation to the performance of the PRM tool.
- The researchers indicate the potential to develop separate Māori and non-Māori models in order to ensure equivalent performance for Māori and non-Māori

Limitations: Despite these strengths there are some significant limitations and concerns in relation to the PRM tool and the feasibility testing from a Māori perspective. This includes:

- The study lacks clarity of purpose or stated objectives in relation to issues associated with the feasibility of the PRM model for predicting Māori child maltreatment.
- A lack of detail is provided about a number of key variables and processes of importance for this analysis in relation to Māori including ethnicity data, ethnicity linkage, lack of presentation of findings for PPV, NPV. This also means it is difficult to draw firm conclusions about the feasibility for Māori.
- Some important findings related to Māori are not discussed in detail however entered as notes (e.g. ethnicity under table 4) or as footnotes (e.g. footnote page 23 Interim Findings report – findings for sole Māori are presented but not discussed anywhere else).

- There are recognised criticisms of stepwise regression models within the statistical literature, these criticisms have not been commented upon or discussed within the decision-making around the choice of modelling tool.
- Key findings are presented for the total model however not for Māori for many analyses e.g. Appendix 5 – technical report where the profile of children with maltreatment at age 2 could be compared with the 3% and 5% PRM scores for the total cohort however not for Māori and for non-Māori.
- The presentation of only some analyses for Māori creates an impression that issues of particular relevance for Māori, are less relevant in determining the feasibility of the tool than findings overall. This creates a potential risk that falls disproportionately on Māori if less effective for Māori.
- There is a lack of detail in relation to 'what other models' have been considered for use.
- There is commentary that this model "performs well" and is "feasible to implement" compared to other tools developed to predict the risk of future maltreatment of newborn children. There is insufficient information provided to feel confident in this conclusion, particularly for Māori.
- Predictor variables do not include measures associated with socioeconomic hardship (apart from deprivation); including equivalised household income, overcrowding etc and these may be available through administrative sources[8].

4.2 RECOMMENDATIONS

(i) The research programme around PRM development, testing and application requires a clear set of questions, up front, outlining the 'study questions' in relation to ethnicity and Māori. This includes clear 'up-front' stated purpose and objectives in relation to Māori data and analyses associated with the PRM tool and in the accompanying reports (outlined in the Interim Report Executive Summary). These should include ensuring specified objectives to address the identification and addressing of Māori related issues in the development and feasibility testing of the PRM tool(s). Analyses such as that shown in Table 2 (Interim Findings report) should be shown for Māori and comparison made with regards to how the model differs between Māori and non-Māori for all the important measures – false positive, PPV, NPV, referred sensitivity, non-referred sensitivity.

(ii) The other accompanying reports should also ensure relevant issues for Māori are well addressed including: the ethical issues in relation to Māori issues / challenges faced by the research, exploration of Māori specific perspectives within the qualitative research being undertaken, Māori related issues associated with evaluation.

Approaches to ensure a comprehensive approach to exploring the feasibility of PRM for Māori include:

- Provide an accompanying report that encompasses the range of issues for Māori associated with the PRM development, feasibility and application – this would incorporate aspects of analysis of tool development, ethics, Māori stakeholder perspectives and issues for evaluation and application. Or alternatively:
- Identify the range of key issues for feasibility related to PRM and Māori across all analysis / report areas (feasibility study, ethics, qualitative etc) and ensure that Māori related objectives are explicitly stated and incorporated into each of the pieces of work being undertaken to support the PRM process.

[8] These may not be available as administrative data however it would be good to see some commentary about this.

(iii) Additional research highlighted by the authors is important and should be supported. It would be useful to position that research within the context of clear stated objectives in relation to research questions related to the feasibility of PRM and Māori.

(iv) Extreme caution must be taken in ensuring there is a high degree of comfort that the PRM is safe, effective and not likely to lead to harmful outcomes to Māori, before it is rolled out. There are important criticisms of stepwise logistic regression as a predictive modelling tool within the statistical literature and these criticisms would be useful to see described and addressed.

4.3 Overall Conclusions

The researchers highlight the novel nature of the development of a PRM tool for child maltreatment. Given this is new research territory in such an important area for Māori, then it is crucial to identify and address limitations or issues (technical, ethical etc) associated with the development prior to application of the tool of particular importance for Māori. The researchers have worked hard to address many issues and there appears another layer of objectives, analysis and interpretation related specifically to Māori.

Māori children are over-represented among child maltreatment statistics and 'getting it right' for Māori children is a priority. The importance of 'getting it right for Māori' needs to be clearly and overtly reflected within the model development, testing of its feasibility and consideration of application.

There was insufficient information in this report to compare in detail the sensitivity, positive or predictive value of the tool between Māori and non-Māori. At this point there is insufficient information to feel confident that this tool is robust as a foundation for broader application among Māori children and whānau. The finding from this research that the model would disproportionately misclassify Māori risk suggests more work is required to understand how best to create a model that performs well for Māori.