Healthy Homes Initiative:

Three year outcomes evaluation

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ACKNOWLEDGMENTS

There are many people we would like to acknowledge and thank.

We would firstly like to acknowledge the whānau who have been part of the Healthy Homes Initiative journey so far. Thank you for sharing your stories and data with us, only through your gifts is this report possible.

We would like to thank the Healthy Homes Initiative workforce. You have worked tirelessly to improve the housing and support for whānau. You have also gained the content of whānau to share the data with us.

Thanks also to the local and national funders and supporters who have provided interventions and support to this programme.

Lastly, we would like to thank the Ministry of Health (now Te Whatu Ora - Health New Zealand) and the other partners and government agencies who have made this evaluation possible and for their ongoing support and partnership.

Ngā mihi nui,
The evaluation team.

DISCLAIMER

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is managed by Stats NZ. For more information about the IDI, please visit https://www.stats.govt.nz/integrated-data/.

The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes and is not related to the data's ability to support Inland Revenue's core operational requirements.

This report was funded by the Ministry of Health (now Te Whatu Ora – Health New Zealand), the Ministry of Housing and Urban Development, and Kāinga Ora – Homes and Communities.

KEY POINTS

Warm, dry and healthy homes can lead to better health and social outcomes. The Healthy Homes Initiative (HHI) is **making a tangible contribution to better health and social outcomes** for referred whānau. This evaluation helps to demonstrate the impact of the HHI at a population-level.

The HHI **significantly reduces hospitalisations** for both the referred child and the wider whānau. This evaluation found that after the HHI intervention the number of hospitalisations per person was reduced by 19.8% (or 9,744 across the HHI cohort per year). This evaluation also shows that when people were hospitalised, these hospitalisations were shorter and less severe on average than previous hospitalisations prior to the HHI intervention.

This evaluation shows that the **HHI is increasing school attendance**. It found a small but statistically significant reduction in days off school for medical reasons, resulting in approximately 1,870 more days at school (for the whole HHI cohort).

This evaluation suggests that the HHI intervention has a positive impact on employment, with a **4% increase in employment in adults aged 24 to 64**. The HHI is also changing the means of income for many whānau from government benefits to paid employment, with a moderate reduction in the cost and number of government benefits received by whānau (approximately $200 less per whānau per year).

The HHI is making a huge difference to equity. **Nearly half of the cohort are either Māori (48.7%) or Pacific (46.1%)**, and therefore the positive effects of this programme are concentrated within these groups, helping to improve equity in health and social outcomes.

As demonstrated in the interim phase 1 report,[1] the HHI is a hugely cost beneficial programme. This evaluation shows that the value of the social benefits from the HHI alone exceed the programme cost resulting in a **return on investment within one year**.

The HHI dataset is the largest physical examination of housing in the StatsNZ integrated data infrastructure. **This evaluation (in addition to the interim phase 1 report) provides timely evidence of the importance of warm, dry and healthy homes for health and social wellbeing**. Further analysis and evaluation of the HHI will be ongoing to build the evidence base and demonstrate the continued impact of this programme.

1. https://www.motu.nz/assets/Documents/our-work/urban-and-regional/housing/Healthy-Homes-Initiative-Outcomes-Initial-Evaluation.pdf

EXECUTIVE SUMMARY

The purpose of this evaluation is to determine whether the Healthy Homes Initiative (HHI) has improved health and social outcomes for participating families, and if it offers value for money.

The aim of the HHI is to increase the number of children living in warm, dry and healthy homes and to reduce avoidable hospitalisations and ill health due to housing-related conditions. The HHI was established in 2013 and currently covers 11 regions in the North island. The HHI is currently being rolled out to the remainder of the country

Initially, the programme targeted low-income families with children at risk of rheumatic fever, but the breadth of the programme was expanded in 2016 to focus on warm, dry and healthy housing for low-income whānau with 0- to 5-year-old children and pregnant people.

The analysis detailed in this report looks at a three-year follow-up period for the referred whānau after the HHI referral and after all interventions have been completed.

KEY FINDINGS AND RESULTS

By December 2021, the HHIs had completed 28,901 referrals.

75,858 people from 14,625 households were identified as having been through the HHI process. 53% were children, 48.7% identified as Māori and 46.1% identified as Pacific.

Hospitalisations: After the HHI intervention the number of hospitalisations per person was reduced by 19.8%. Or 9,744.58 per year and the remaining hospitalisations were less severe.

Education: After the HHI intervention there was an increase in school attendance with absences 3% lower than before.

Income: After the HHI intervention, adults aged 24 to 64 were on 9% less benefits and were 4% more likely to be employed.

Costs and Benefits: The main costs of the HHI programme were the staffing costs for delivering the programme. These costs were $55,651,000 from the start in December 2013 until 31st December 2021. This does not include the costs associated with provision of some of the interventions. This evaluation shows the benefits of the HHI programme greatly exceed the costs in the first-year post-intervention. The data indicates that the benefits are persistent and will accrue each year.

CONCLUSION

This evaluation demonstrates that this programme is making a tangible impact for HHI whānau, as they are spending less time in hospital, and more time in school and in employment. There is unambiguous evidence of broad improvements in wellbeing. The HHI is reaching low-income Māori and Pacific populations and therefore will be helping to address equity in health and social outcomes. This programme is an excellent return on government investment.

INTRODUCTION

The purpose of the Healthy Homes Initiative (HHI) Outcomes Evaluation is to determine whether the HHIs have improved health and social outcomes for families who have taken part, and whether the programme offers value for money.

The evaluation is co-funded by the Ministry of Health (Te Whatu Ora - Health New Zealand), Kāinga Ora – Homes and Communities (Kāinga Ora) and the Ministry of Housing and Urban Development (HUD). The findings from this evaluation will inform and enable cross agency efficiencies in the HHI process to support health, social and wellbeing outcomes.

The interim evaluation in 2019 looked at the health outcomes for the year after the referral for the referred child. This interim evaluation concluded that the programme was producing a large health benefit and savings to the health sector. The key findings were that the HHI programme resulted in 1,533 fewer hospitalisations, 9,443 fewer GP visits and 8,784 fewer filled prescriptions in the first year after the programme's intervention. The savings to the health care system due to these reductions were estimated to be approximately $10.4 million. In total, the HHI programme was expected to avert approximately $30 million in health care costs over a 3-year period. The return on investment was expected to be less than two years.[2]

A process evaluation of the HHIs was completed in May 2018.[3] Overall, the evaluation found that the HHIs are exceeding or meeting expectations in all key areas and a number of opportunities across agencies were identified to strengthen the model's effectiveness.

This phase expands on previous reports, with a longer timeframe and a wider focus inclusive of the household whānau. We look at health, education and social benefits to the referred child and their whānau over the three years following the HHI referral.

BACKGROUND TO THE HHI

The aim of the HHIs is to increase the number of children living in warm, dry and healthy homes and to reduce avoidable hospitalisations and ill health due to housing-related conditions.

The HHIs were established from December 2013 and currently cover 11 regions.[4] The programme is being rolled out to the remainder of the country from 1 July 2022, following additional funding from Budget 2021. The programme consists of predominantly Māori and Pacific providers who ensure and enable a "by community, for community" approach with a strong equity lens. The HHI providers are passionate, committed and work hard to support and enable whānau, taking a strong whānau-centred approach.

Initially, the HHIs targeted low-income families with children at risk of rheumatic fever who were living in crowded households. The breadth of the programme was expanded in 2016 to focus more broadly on warm, dry and healthy housing for low-income families with 0-5 year-old children and pregnant people.

The programme is funded by the Ministry of Health (now Te Whatu Ora - Health New Zealand) and they provide oversight, relationship management/ support and facilitate learning and sharing across the regions. The programme is delivered by a range of providers and sub-contracted providers, such as Māori health providers, housing and sustainability providers, and public health providers.

2. https://www.motu.nz/assets/Documents/our-work/urban-and-regional/housing/Healthy-Homes-Initiative-Outcomes-Initial-Evaluation.pdf
3. https://www.health.govt.nz/publication/healthy-homes-initiative-evaluation-final-report
4. Auckland, Waitematā, Counties Manukau, Northland, Waikato, Hutt Valley, Capital & Coast, Lakes, Bay of Plenty, Hawke's Bay, Tairāwhiti

As of 30 December 2021, 28,901 referrals have been made to the HHI and over 90,000 interventions have been provided to families.

The HHI providers identify eligible families, undertake a housing assessment and then work with agencies and other partners to facilitate access to a range of interventions to create warmer, drier, healthier homes. These interventions include insulation, curtains, heating sources, minor repairs, and support with private/community/social housing relocations, and other housing-related interventions or referrals to health and social agencies as required, and with consent from whānau. Providers take a tailored whānau-centred approach. They also provide information to families about practices to help keep a house warm and dry, and to reduce risks associated with household crowding.

Since the inception, the Ministry (now Te Whatu Ora – Health New Zealand) has worked with key government agencies, such as Kāinga Ora, the Ministry of Social Development (MSD), the Energy Efficiency and Conservation Authority (EECA), the Ministry of Business, Innovation and Employment (MBIE) and HUD, to improve and streamline processes (or to develop new ones) for families most in need.

CASE STUDY 1

In Hawke's Bay, a grandmother and her five grandchildren were referred to the Child Healthy Housing Programme after one child got pneumonia. The whole whānau had respiratory issues and one child was in a wheelchair with high health needs.

The rental property they lived in was uninsulated and draughty. Weatherboards and flashings were missing, the ceiling was sagging, and black mould was growing in the bedrooms. There were no smoke alarms in the house.

The Child Healthy Housing team helped this whānau to find a long-term rental which was dry, insulated, had new carpets and curtains, as well as a compliant fireplace. The team arranged for wheelchair modifications to the house and sourced free bunks and bedding for the whānau.

Following the HHI intervention, the whānau felt happy and secure in their new home, and the following winter they had no hospital admissions.

METHOD

REFERRAL DATA

The HHI providers were asked to provide information on clients who have consented to participating in this evaluation to the University of Otago team. This information was collated by the evaluation team and linked to the Integrated Data Infrastructure (IDI) by Statistics New Zealand (StatsNZ). This information included the National Health Index (NHI) of the primary referred client and information on a range of house/household conditions, interventions that were needed to improve these, and whether these were delivered or not and the relevant dates. These included information on, for example, crowding (functional, structural), curtains, insulation, ventilation, injury hazards, mould, and minor repairs.

The IDI is a large-scale database containing linked microdata about people in New Zealand. It consists of administrative records of services provided by various government agencies, nationwide surveys including the New Zealand census, and data collected by multiple non-governmental organisations. The IDI is maintained and regularly updated by StatsNZ, the government data agency. All the data on the IDI is deidentified to protect privacy and the data can only be worked with under the "five safes framework" safe people, safe projects, safe settings, safe data, and safe output. Within the IDI, individuals are assigned unique, anonymised identifiers that researchers can link across interactions with government agencies.

The HHI dataset is the largest community-collected data set on the IDI. It provides detailed information on the timing of the wide-ranging interventions provided by the HHI providers. These data are now available for appropriate public good research by StatsNZ approved researchers. Allowing other agencies to look at the importance of housing quality for low-income Māori and Pacific whānau in their existing work. The data will be updated annually.

Ethics approval for this research was granted by the University of Otago Human Research Ethics Committee, reference number 16/049.

LINKAGES ON THE IDI

StatsNZ link the referred child using their NHI then assign unique anonymised identifiers (SNZ_UID). The SNZ_UID was used to link to individual 2018 census data across the IDI spline, using the March 2022 IDI data refresh. Households were then constructed based on primary residence household-level census information. To maximise linkages to households, where the child was not able to directly link to census information, attempts were made to link to parental data using relationship data tables. The parental information was then used to link to the household.

Hospitalisation records were taken from the Ministry of Health National Minimum Dataset (NMDS) on the IDI, publicly funded outpatient events. Education attendance records were taken from the Ministry of Education dataset on the IDI. The dollar value of benefits received was taken from the Inland Revenue (IR) taxable income database and the number of different benefits accessed was taken from the MSD Benefit Dynamic dataset.

PROGRAMME COST DATA

The main costs of the HHI were the staffing costs for delivering the programme. These costs were $55,651,000 to December 2021. The other cost is the costs of the intervention funded by philanthropic and community partners and support from other government agencies, especially EECA and Kāinga Ora. These will be established in future reports.

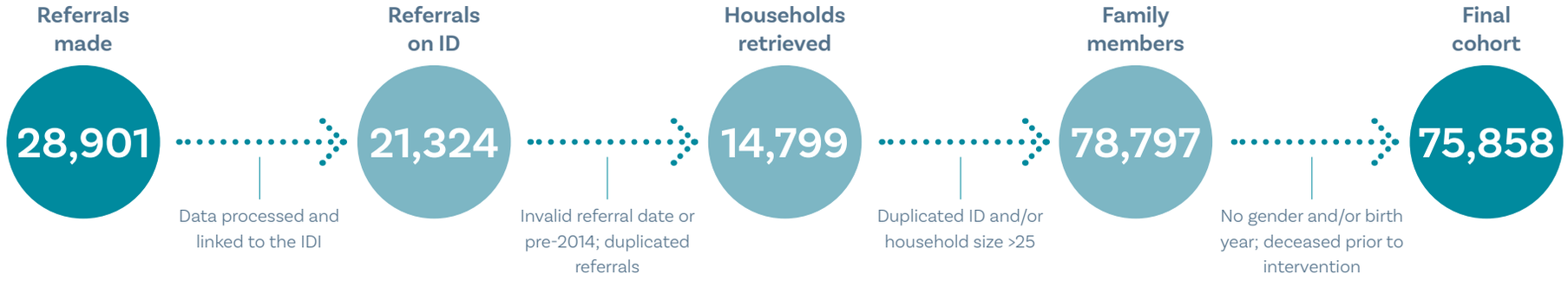
SAMPLE DESCRIPTION

Of 28,901 referrals made between December 2013 and December 2021, the IDI data contained at least some information on 21,324 referrals. After removing referrals with invalid or incorrect dates (pre-2014), 14,799 households were linked using the 2018 census usual residence dwelling identifiers (Dwelling ID) where each household was determined by a singular Dwelling ID. Duplicated Dwelling IDs were then removed as well as households over the size of 25 members. This linked to 78,797 likely HHI whānau members. A final data clean removed 2,939 people who had no gender and/or birth year or who were deceased prior to the HHI intervention. The resulting cohort identified 75,858 individuals in one of 14,625 HHI whānau households, with approximately 2% of households defined by only the referred child and no linked household members.

"The grandmother was amazed at the difference and impact their home had on their children's health since Whare Ora have supported them. The children now have their own separate safe sleeping spaces, and the grandmother has noticed an improvement in the children's health due to a warmer and healthier home".

FIGURE 1

HOUSEHOLD LINKAGE PROCESS AND KEY CLEANING STAGES



EVENT DEFINITIONS

Hospitalisations: Each line entry in the hospitalisation database was taken as an individual hospitalisation. This means that transfers between hospitals (or occasionally, wards) as well as discharge and same-day readmission as separate hospitalisations have been counted separately. These events are rare. The cost weightings as used for charging Ministry of Health, were used to estimate the cost (severity) of hospitalisations.

Days absent from school: For students in the linked cohort aged 6 to 15, the total number of medical absences prior to an intervention was taken as the total days absent (full and partial) marked as for medical reasons recorded up to three years before the start of the intervention period in annual increments. Similarly, the post-intervention absences are recorded as the sum of medical absences up to three years after the end of the intervention period and also in annual increments. Due to inconsistent recording of attendance data in the years leading up to 2019, only May/June data, which is recorded from 2011 to 2020, was used.

Wages and salaries: For those aged over 24, income data was extracted from the IDI income calendar year summaries table. This table records the total income from wages and salary (along with other sources) at the monthly level and is supplied by Inland Revenue. An indicator for whether anyone earned wages and salaries was constructed and used as a measure of employment.

Dollar value of main benefit received: Monthly income data for adults in the linked HHI cohort aged over 24 was extracted from the same income tables as used for wages and salaries.

Number of Benefits Received: For participants in the linked cohort aged 16 to 64, the total number of benefits received in an outcome year was calculated using the sum of the number of benefits received by an individual in the Benefits Dynamics Database which is supplied by MSD. Each line entry in the Benefits Dynamics Database was taken as an individual benefit and benefits were included in an individual count if the benefit was at least partially paid during the outcome year, with no limitation on benefit type or minimum period.

UNIT OF ANALYSIS

The unit of analysis is the individual in a household with a HHI referral. Most children were referred to an HHI provider only once. However, in rare cases (generally when the family moved) there would have been multiple HHI referrals for the same child. All referrals were included and counted as separate observations in the analysis in these cases because of the different timeframes relevant for each referral. However, if multiple family members from the same household received individual referrals in the same time period, these were collapsed to one unique referral.

For each referral, an intervention date was calculated. There was wide variety in extent and type of interventions needed for each house. This meant the timeframes for the delivery of the intentions varied. To simplify we assumed a uniform 90 day period of intervention dellivery. The resulting intervention date was therefore calculated as 90 days from the house assessment date. Where a referral was missing a valid date for the house assessment, the referral date or earliest intervention date was used in its place if possible.

ANALYTICAL APPROACH

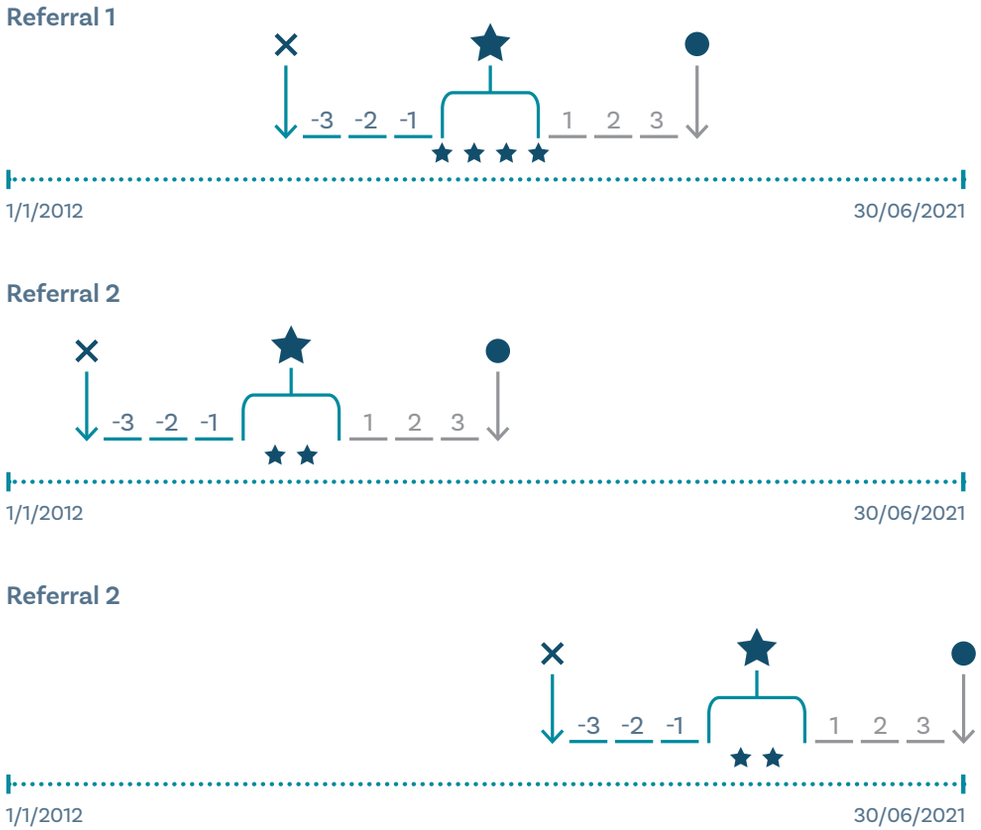
For each referral, data was collated from two periods either side of when the referred child/ whānau were engaged with a HHI provider to receive interventions. This is pre-post data and was treated accordingly. The number of events happening in the three-years either side of this 'intervention' period were used to obtain counts of 'pre-intervention' and 'post-intervention' events on a referral-by-referral basis.

The 'pre-intervention' period was considered as the three years immediately before each referral's 'intervention start' date. The 'post-intervention' period was the three years immediately after the latest intervention date provided for each referral.

"Following the HHI intervention, the family felt happy and secure in their new home, and the following winter they had no hospital admissions".

FIGURE 2

EXAMPLE OF ANALYTICAL APPROACH FOR THREE HYPOTHETICAL HHI REFERRALS OVER TIME PERIOD OF AVAILABLE HEALTH OUTCOMES DATA (2012-JUNE 2021)



For each analysis of the four outcome measures (hospitalisations, days in school, value and number of benefits), the difference between the number of events happening in the post-intervention period with regards to the pre-intervention period was found on an individual-by-individual basis for each member of the referral household. Any events that happened for the individual between the earliest and latest intervention dates of their referral (i.e., within the 'intervention' period of the HHI referral) were excluded. This means that all the pre- years occur before any intervention has taken place and the post- years occur only after all the interventions provided have taken place. This avoids anytime where people have only a partial HHI effect.

The number of events that occurred for each referral in the three-year post-intervention period was compared to the number in the three-year pre-intervention period, which allowed for estimation of the reduction in the number of events (hospitalisations, days in school, value and number of benefits) attributable to the HHI programme.

Known effects that might lead to overestimation of this difference were adjusted for, for example age effect and the effects of Covid-19 restrictions. These were adjusted where appropriate to obtain accurate estimates of an effect likely attributable to the HHI across each of the four key outcomes. These adjustments are described below.

CORRECTIVE ADJUSTMENTS

To improve the reliability of estimates of any differences in the post-intervention periods compared to the pre-intervention periods attributable to the HHI, methods were established to control for known biases present in pre-post analyses of this kind. An explanation of these effects and rationale for addressing them are explained below.

Aside from the HHI programme effect, age effect, and the effect of the varied Covid-19 restrictions from April 2020 onwards there are unlikely to be any other major systematic effects in the before and after comparison for the outcomes. Therefore, we can estimate a programme-attributable change in outcomes by adjusting the necessary pre-intervention/post-intervention counts for the estimated age and Covid-19 effects. For all three outcomes, both of these effects were adjusted for, as further explained below. We used full year periods to remove any seasonality effect.

AGE EFFECT

For education we restricted the cohort to those aged 6 to 16 years. Each individual in the cohort will be systematically older in the post-intervention period compared to their pre-intervention period. This effect of age happens differently for the three different outcomes (hospitalisation, education, benefits).

Hospitalisation broadly increases with age however it is much more common for younger children and older adults. Hospitalisation events are restricted to those aged over one month at the start of an observation period. To allow for the effect of age on hospitalisations three terms to the model were added, as below.

1. **Age:** allows for the general linear increase in hospitalisations as people age
2. **Age (children):** Age in years for those less the 18 and this allows for the higher hospitalisation for younger children
3. **Age (adults) older age:** Age in years for all those over 50 and allows for the higher rate of hospitalisations for over 50s.

Age was modelled using two terms: a continuous measure of age, and the continuous measure of age interacted with an indicator for being over 12. This allows for differences in absences patterns for primary/intermediate school children and secondary school children.

Benefit modelling was restricted to those aged 24 to 64 due to the significant change in benefit mode over the age of 64 as people strongly shift to users of the government's superannuation scheme.

CASE STUDY 2

The Bay of Plenty HHI provider supported a mum of three. The whānau-owned home had single-glazed wooden windows which were in poor condition and the home needed some repairs and maintenance. The home was cold, damp and making the children unwell throughout the winter.

The HHI provided information, support, as well as help with the draughty windows, providing draft stop tape. They were also able to deliver a community donated single bed and a cot for the children.

Double layered curtains were also delivered to the whānau by the Red Cross Curtain Bank.

The mum was very grateful with an immediate text of thanks: "Loving the draught tape, lols, who needs new windows with that stuff, ha, thanks again". The relationship between the mum and the HHI assessor developed over several months and has resulted in an open and caring relationship of mutual respect. The mum is feeling motivated and supported.

COVID-19

New Zealand and its health, education and benefit systems had a variety of responses in order to mitigate the effects of the Covid-19.

For health, these had the effect of reducing hospitalisations sharply from March 2020 until the end of 2021. Because this time period is towards the end of the analysis period, it appears in more of the "post-intervention years" than the "pre-intervention years". Therefore, a Covid term has been introduced to allow for this reduction in hospitalisations from March 2020 to December 2021.

In education, during the Covid-19 outbreak schools were closed during various stages of the outbreak and student absences were higher due to both the disease and restrictions. The education model therefore has a term to allow for the overall change due to Covid-19. The effect of Covid-19 and the restrictions on school absence was so severe that a model with only the pre-Covid data has been shown for comparison.

Covid-19 and the government response also affected the employment market. The effect of Covid-19 on jobs has been uneven with high-demand areas expanding but other sectors experiencing high losses. The Covid-19 correction is important for modelling of employment and income due to the unpredicted variation experienced due to the pandemic.

These corrections for Covid-19 will likely not be as important in future analysis when more referral periods are occurring after Covid-19 restrictions so corrections in future analysis will look different.

Figure 3 on the following page shows the predicted hospitalisation rates by age and stratified to illustrate the effect of Covid-19. There are two panels, one for predicted hospitalisation rates before Covid-19 (upper) and one for after (lower). Comparing the upper and lower panels, the adjustment for Covid-19 acts as a constant on the rates and therefore both lines (pre- and post-intervention) appear to be shifted downwards in the lower panel reflecting the reduction in hospitalisations experienced whilst Covid-19 restrictions have been in effect. Each panel features two lines, one for the three years pre-intervention (blue) and one for the post-intervention (purple). The positive effect of the HHI on hospitalisation rates is shown by the gap between the two lines, where the post-intervention line is significantly lower than the pre-intervention line. Each of the lines also feature "pivot points" at ages 18 and 50 years where the gradient of the line is allowed to change. This reflects the correction for age effect in the model and speaks to the changing risk of hospitalisation at different life stages.

ESTIMATING UNCERTAINTY

In order to measure the uncertainties around the estimates, the outcomes were modelled using well-known statistical models. Hospitalisations and school absences were modelled using quasi-poisson models with scaled overdispersion. The likelihood of benefit receipt and employment were modelled using logistic regression with robust standard errors. To examine changes in income due to main benefits and earnings, linear regression was used with robust standard errors to estimate the size of the change on average across the HHI cohort.

LIMITATIONS

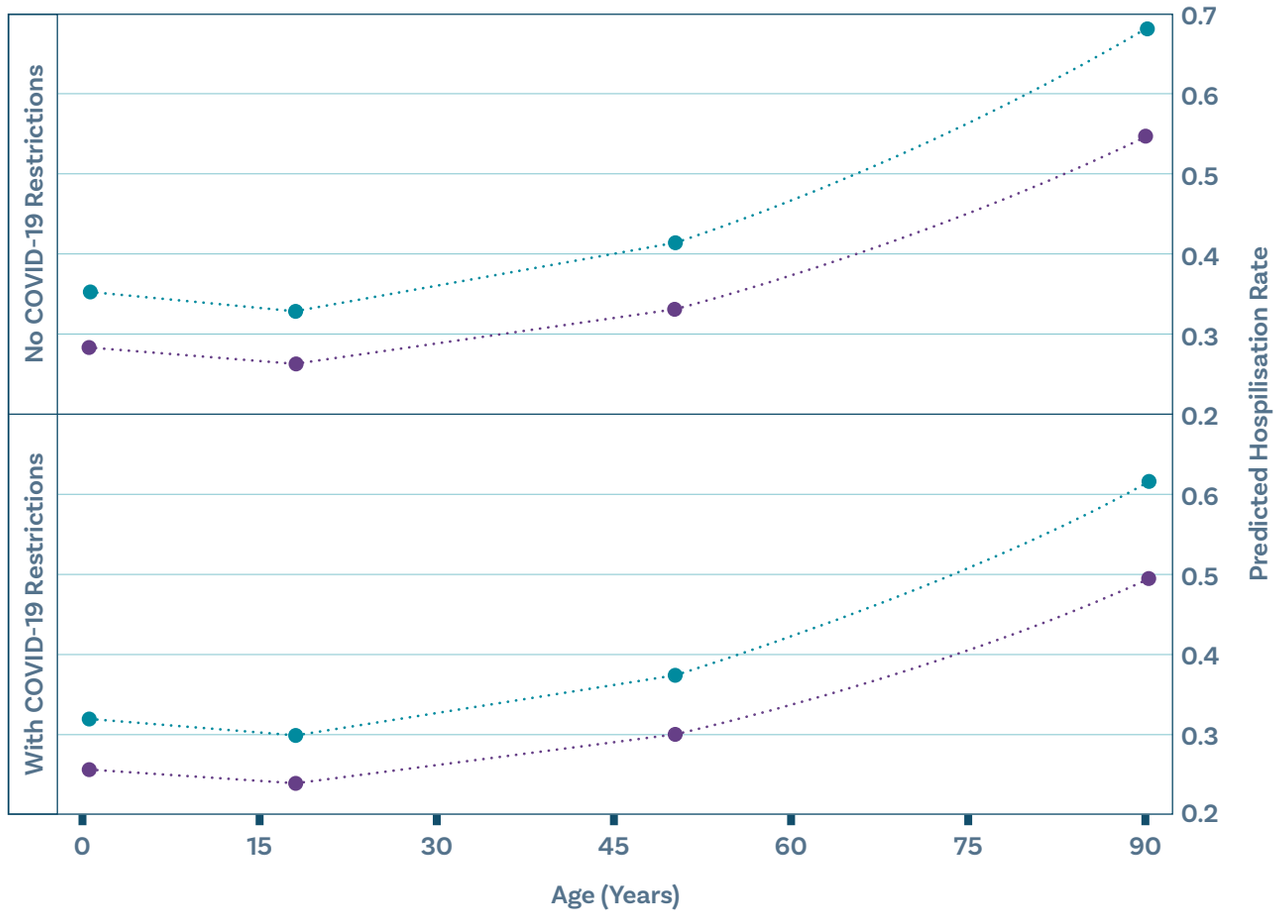
Multiple referrals, where a household had more than one referral at the same time were reduced to one referral. Multiple referrals, where a household had more than one referral during different time periods, where treated as separate independent events in the analysis. No adjustment was made for any correlation in effect size by household. This has no effect on the average reported effect size but would have a negligible effect on the model variation.

RESULTS

COHORT DESCRIPTION

The HHI population was young with over 50% of the sample under 18. They were more likely to be Māori (48.7%) or Pacific (46.1%) than the general population, which is 16.5% Māori and 8.1% Pacific. Most people (75%) lived in rental housing with the public provider Kāinga Ora and private rental being equally common. Owner-occupied housing amongst the referrals was relatively rare (10%). Table 1 summarises these results.

FIGURE 3 PREDICTED RISK OF HOSPITALISATION BY AGE (YEARS) FOR HHI COHORT



CASE STUDY 3

A whānau was living in a remote Eastern Bay of Plenty community. Due to overcrowding, the mother of the referred child purchased a derelict house and began the process of renovating and repairing.

The home was completely gutted, no wall lining, a leaking roof, no power, no water and no heating.

The HHI assessor supported an application for critical repair funding from Te Puni Kokiri and were successful. Te Puni Kokiri provided a new roof, water supply and plumbing for a new bathroom and shower. Mum was very active in seeking to improve her position and enrolled with her local Whānau Ora Paiārahi.

The HHI assessor collaborated with the Whānau Ora Paiārahi and spent the winter seeking to get the power connected, the windows and fire installed, the home insulated, and the walls lined. The power was finally connected to the home with the help of the Whānau Ora Paiārahi, 20 Degrees, government agencies such as MSD, Te Puni Kokiri, the HHI provider and community contacts. The next phase included installation of insulation, heating, and windows.

Following the support and improvements to the house, the HHI assessor received a text from the mum “I’m so happy I could cry”.

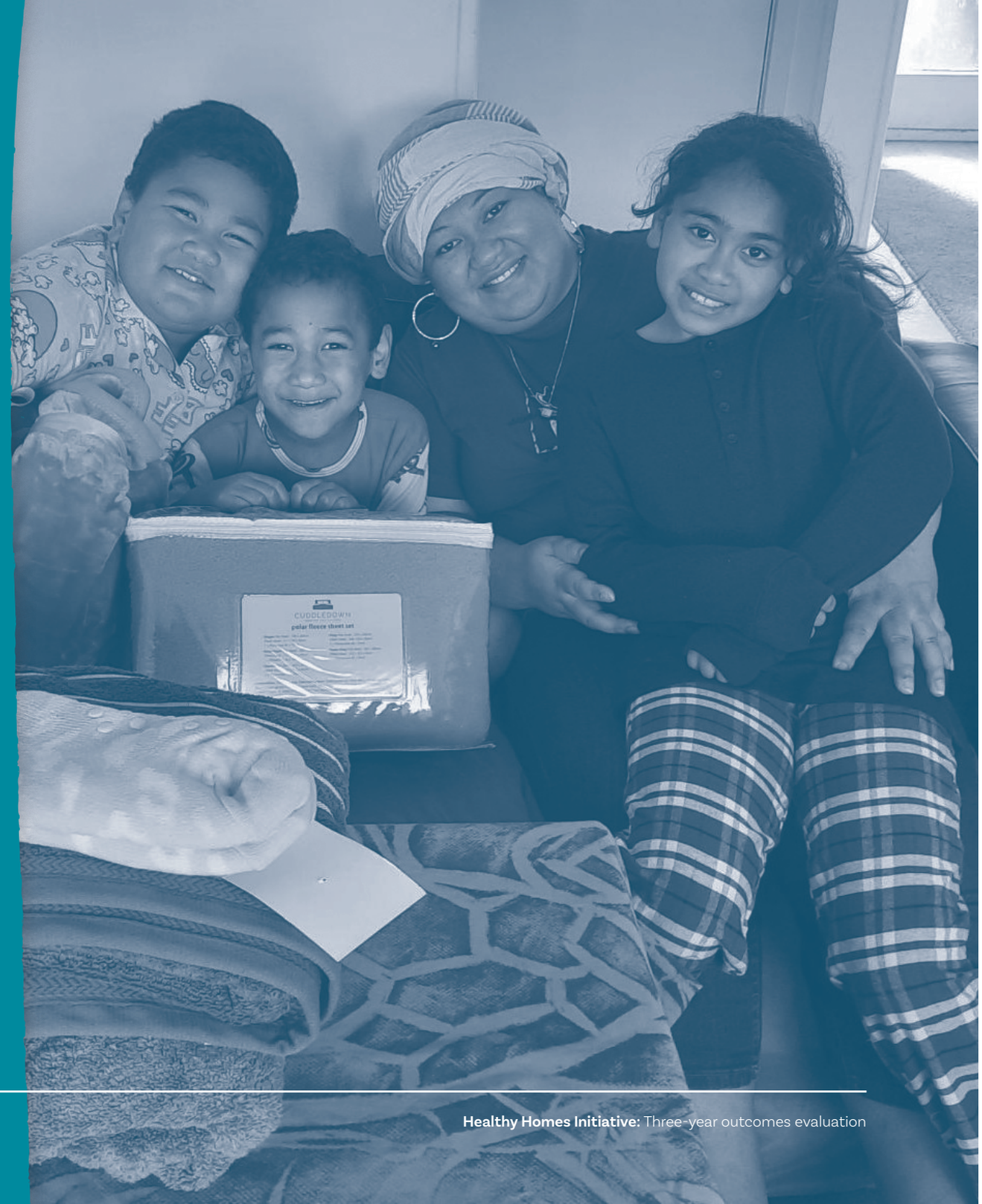


TABLE 1

CHARACTERISTICS OF LINKED HHI COHORT

VARIABLE		COUNT*	RELATIVE PERCENTAGE (%)
Age at earliest intervention	<2	6,045	8.0
	2-4	8,841	11.7
	5-17	24,081	31.7
	18-24	7,476	9.9
	25-44	19,452	25.6
	45-64	6,954	9.2
	>64	1,548	2.0
	Born post-intervention	1,461	1.9
Ethnicity**	Māori	36,936	48.7
	Pacific	34,947	46.1
	European	20,916	27.6
	Asian	3,666	4.8
	MELAA	1,767	2.3
Sex	Male	35,034	46.2
	Female	40,824	53.8
Tenure	Owner occupied	13,236	17.4
	Kāinga Ora – Homes and Communities	28,536	37.6
	Private market rental	28,389	37.4
	Other	5,550	7.3

Note:

* Unweighted counts have been rounded to base 3 for confidentiality

** Total response, multiple ethnicities allowed

Across all referrals in the linked sample, the earliest intervention date was in January 2014, and the latest intervention date for referrals was December 2020. The median referral for the sample took place in 2018.

CASE STUDY 4

A whānau of six were living in a rental property. Three children had respiratory issues including bronchiolitis and multiple positive Strep A.

The house included an unconsented bathroom, the insulation was inadequate, there was exposed wiring, missing and rotten weatherboards, pools of water under the floor, large holes in wooden floors, and other safety issues within the home.

The HHI assessor was able to complete minor repairs including some draught proofing, glazing, rodent control, curtains, carpet squares, and source new beds and bedding. The assessor was able to provide information on home maintenance and addressing mould, condensation, effective heating, and electricity tips to minimise power consumption and monthly bills. The HHI assessor also supported the whānau with additional support from MSD.

The HHI assessor discussed the options available to the tenant regarding the Tenancy Tribunal and advocacy via Community Law. Following this, the tenant actively pursuing a complaint to the Tenancy Tribunal with the support of the HHI assessor. The whānau were successful, being awarded compensation and the landlord was required to address the issues raised. The tenant was then supported to secure a new private rental and the whānau are now living in a warm, dry home.

The HHI assessor stated "the mother is now confident in her knowledge around maintaining a healthy home and aware of her rights as a tenant. The children's health has improved, and no hospital stays so far. The children are settled into new schools and mum has found part-time work and is also persuing community courses to enhance the knowledge she learnt along her journey".

HEALTH OUTCOMES

HOSPITALISATIONS

Table 2 shows the effect of the HHI programme on hospitalisation numbers. The odds ratio shows that after adjustment for age and Covid-19 odds, were 80.2% of the hospitalisations per year after the intervention compared to before the intervention. This 19.8% reduction means that this model shows that the HHI programme prevented 4,931 hospitalisations per year in the linked cohort or 0.065 per person per year. The HHI data on 14,625 referrals and 75,858 individuals shows that 14,793.37 hospitalisations were averted in the three years after the HHI intervention.

This scales up to an estimated 9,744.58 hospitalisations averted per year over the entire 28,901 referrals carried out. This effect is consistent (Table 2A) over each of the three years post-intervention period, which is 29,233.74 over three years.

TABLE 2

RESULTS OF MODELLING OF HOSPITALISATION NUMBERS

MODEL TERM	ODDS RATIO (95% CI)	P-VALUE
Age (all) (Age at middle of outcome year)	1.01 (1.01, 1.01)	<1:10,000
Age (children) (Adjustment for children <18 years)	0.989 (0.986, 0.992)	<1:10,000
Age (adults) (Adjustment for adults >50 years)	1.01 (1.00, 1.01)	0.00327
HHI Effect (Effect attributed to intervention)	**0.802 (0.785, 0.820)**	<1:10,000
Covid-19 Adjustment (Correction for effect of Covid-19)	0.902 (0.876, 0.929)	<1:10,000

SOCIAL OUTCOMES

EDUCATION

The results showed a small but statistically significant reduction in days off school for medical reasons. This was consistent when both the full sample was used for modelling and when the sample was restricted to only pre-Covid observations (Table 3). In the linked cohort of 14,625 referrals with 20,376 6- to 16-year-olds, this came to 946.3 days extra in school per year. Across the 28,901 referrals an estimated 1,870 extra days were spent in school due to the HHI.

BENEFIT RECEIPT

IRD records were used to examine the incomes of people aged 24 to 64 receiving benefits (such as Jobseeker Support, Sole Parent Support and Supported Living Payment) from the government. Linear regression was used to examine how the total amount of benefits individuals received differed before and after the intervention. Results are presented in Table 4 and indicate that the average benefit amount is reduced by approximately $200 per person-year.

TABLE 3

RESULTS OF NUMBER OF DAYS MEDICALLY ABSENT FOR CHILDREN AGED 6-15

MODEL TERM	DAYS ABSENT (ODDS RATIO)	
	ENTIRE PERIOD (1)	PRE-COVID[1] (2)
Post-Intervention	0.970 (0.941, 0.999)**	0.903 (0.824, 0.982)**
Age (all)	1.018 (1.011, 1.025)***	1.011 (0.997, 1.025)
Age*12yo+	0.996 (0.993, 0.999)**	1.000 (0.994, 1.006)
Post-covid	0.646 (0.582, 0.710)***	
Sample	6-15yo	6-15yo
Observations[2]	105,819	29,304

Note:

Standard errors are shown in parentheses

1. Pre-covid sample is comprised of students with all their observations in the pre-covid period.

2. Number of person-years with three years on either side of the intervention; random rounded to base 3 for confidentiality

*** p<0.01, ** p<0.05, * p<0.1

TABLE 4

MODELLED CHANGES IN AMOUNT OF BENEFIT RECEIVED

MODEL TERM	MODEL ESTIMATE+
Post-Intervention	**-197.6 (-281.3, -113.9)*** **
Post-covid	668.3 (337.5, 999.1)***
Age	-82.10 (-106.2, -58.03)***
Age²	0.636 (0.352, 0.920)***
Employed	-3,561 (-3,664, -3,458)***
Sample	24-64yo
Observations++	156,492
R2²	0.349

Note:

+ Standard errors are shown in parentheses

++ Number of person-years with three years on either side of the intervention; random rounded to base 3 for confidentiality

*** p<0.01, ** p<0.05, * p<0.1

NUMBER OF BENEFITS

This next analysis focussed on the raw number of benefits received from MSD by those aged 24-64 in the linked cohort. Modelling was conducted using an quasi-poisson model with adjustment for the effect of Covid-19 restrictions. Age was approximated as linear for this model and due to the absence of children in this sample no adjustments to the primary age term were added. Note that this analysis is supplementary to the other benefit analyses and has not been included in further valuation modelling of the HHI scheme.

Table 5 shows the results of the model for the effect of the HHI on benefit numbers. The odds ratio shows that after adjustment for age and Covid-19 odds were 92% of benefits were received by 16-64 year olds post-intervention as compared to before the intervention. Based on the eligible HHI cohort sample, the model predicted a total of 119,453 benefits in the three years prior to the intervention and 109,718 benefits in the three years post-intervention. Per person per outcome year the number of benefits is estimated to reduce from 0.67 to 0.62, a reduction of 0.05 (7.5%) per person per year.

TABLE 5

RESULTS OF MODELLING OF NUMBER OF BENEFITS RECEIVED BY HHI COHORT

MODEL TERM	ODDS RATIO (95% CI)	P-VALUE
Age (all) (Age at middle of outcome year)	0.996 (0.995, 0.996)	<1:10,000
HHI Effect (Effect attributed to intervention)	**0.918 (0.906, 0.931)**	<1:10,000
Covid-19 Adjustment (Correction for effect of Covid-19)	1.08 (1.06, 1.10)	<1:10,000

CASE STUDY 5

There was a whānau of four, who were offered a Kāinga Ora property.

A HHI assessor from one of the Auckland-based HHI providers, provided the whānau with information and support about how to keep their home warm, dry and mould free.

The mother has reported that the children have less admissions to hospital and reduced GP visits. The mother of the child is now employed with a local emergency housing provider and has assisted with referrals of whānau into the Auckland-based services.

CASE STUDY 6

A baby was born prematurely and stayed in NICU for the first four months of his life and has on-going respiratory issues. The baby's medical team was aware of the poor housing conditions the whānau were living in. Due to the housing conditions, the baby stayed in NICU longer than medically necessary as the medical staff felt it was unsafe to discharge him.

The whānau spoke limited English, they did not have a lot of social support, and lacked confidence engaging social housing services.

The HHI assessor worked alongside the whānau to improve their housing situation and supported them to engage with an MSD housing broker to look for a more suitable private rental property.

The whānau were able to move into a new private rental the same day that their baby was due to be discharged from NICU without having to return to their original unsafe home. Importantly, for the whānau, the new rental property was in the same community as their previous house. This helped with both continuity of health care and social support for the whānau. The whānau now have a greater understanding of how to maintain a warm and dry home.

EARNINGS

Logistic modelling showed that adults aged 24-64 in the household had an increased likelihood of being employed post-intervention of approximately 4%. Results of modelling are presented in Table 6.

TABLE 6

RESULTS OF MODELLING OF EMPLOYMENT

MODEL TERM	MODEL ESTIMATE+
Post-Intervention	**1.039 (1.002, 1.076)****
Post-covid	0.818 (0.742, 0.901)***
Age	1.000 (0.990, 1.010)
Age^2	1.000 (1.000, 1.000)***
Benefit Recipient	0.521 (0.513, 0.529)***
Sample	24-64yo
Robust SE	Yes
Observations++	156,492
R^2	0.388

Note:

\+ Confidence intervals are shown in parentheses

++ Number of person-years with three years on either side of the intervention; random rounded to base 3 for confidentiality

*** p<0.01, ** p<0.05, * p<0.1

COSTS OF PROGRAMME AND COSTS AVERTED

The programme costs for this analysis are primarily related to staffing costs (including overheads) for delivering the programme. These costs were $55,651,000 for the 28,901 families served by the programme through December 2021.

These programme costs do not cover all the costs of the programme. Specifically, the costs of providing some of the interventions (e.g., the cost of providing beds or installing insulation) beyond these staffing costs are not included for this analysis, but these will be analysed in future work. These by others such as philanthropic organisations/other partners (e.g. Variety and EECA).

The associated health care costs averted by the programme are shown in Table 8. Using the average cost of a hospitalisation pre-intervention ($4,751.58), the 9,744.58 hospitalisations averted would have cost approximately $46.3 million in the earliest year post-intervention, and hence, these costs were averted because of the HHI programme. Those hospitalisations that did occur post-intervention for the referral child were less severe, likely due to the programme. This reduction in severity is estimated to avert costs of $13.9 million in the first year, post-intervention.

In the linked referral cohort (14,625 referrals), there are 75,858 individuals or 5.19 individuals per referral. Using this, it is estimated that over the 28,901 referrals, 149,906 individuals lived in the homes seen by the programme in total. Based on this cohort, approximately 35% of our individuals are aged 24-64 which indicates that 52,182 individuals aged 24-64 have been treated by the programme. Moreover, approximately 32% of the cohort is aged 5-17 which indicates that approximately 47,970 children in this age range have been treated by the programme annually. These numbers were used to estimate social benefits of the programme.

TABLE 7

ESTIMATED TOTAL INTERVENTION SIZE BASED ON REFERRAL COHORT SAMPLE

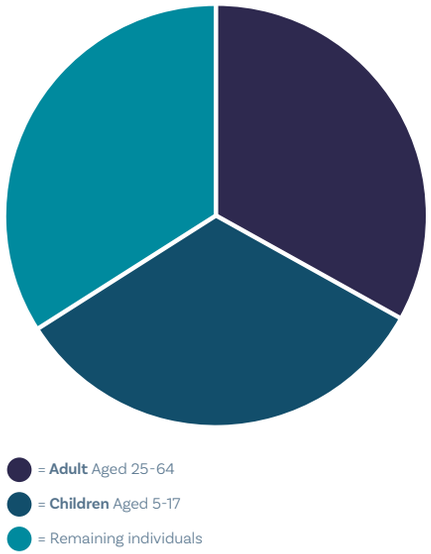
SAMPLE	REFERRALS	INDIVIDUALS	ADULTS AGED 25-64	CHILDREN AGED 5-17
Referral Cohort	14,625	75,858	26,406 (35%)	24,081 (32%)
Total Intervention	28,901	149,906	52,182 (35%)	47,970 (32%)

Note:

Percentages are in terms of individuals in each respective sample

FIGURE 4

PROPORTION OF COHORT BY AGE GROUP



First, for education, there are approximately 1,870 fewer student-days absent post-intervention. The estimated social value of a day of school is approximately $75 per day,[6] and hence, the total value of this reduction in absenteeism is expected to be approximately $140,250. This is a conservative estimate. Discounting this value in years 2 and 3 post-intervention using a rate of 6% as recommended by Treasury[7] reduces this amount to $132,311 and $124,822 respectively for a 3-year total value of approximately $397,383. These results are shown in Table 8.

Results also indicate that, post-intervention, the average reduction in main benefit income is about $200 per person. Based on the estimated number of adults aged 24-64 covered by the intervention, the value of the reduction in benefit income is estimated at $10.4 million.

This is then discounted in years 2 and 3 post-intervention using a rate of 6% as recommended by Treasury, as shown in Table 8. Hence, the 3-year expected value of these benefits are approximately $29.6 million in reduced benefit income.

6. In 2018, the cost per student for primary, secondary, and post-secondary non-tertiary education was estimated by the OECD at USD 9,934 or NZD 14,350. See more information https://www.oecd-ilibrary.org/sites/a6e9b4ee-en/index.html?itemId=/content/component/a6e9b4ee-en#section-d12020e16169. In the 2018 school term, there were 192 whole days of school days in total according to the Ministry of Education. Hence, the cost per day per student is approximately NZD 75.

7. While the interventions occurred over many years, the totals for each year post-intervention have been aggregated. Hence, the total cost-savings for the earliest year post-intervention, second year post-intervention, *etc.*

TABLE 8

BENEFITS OF THE HEALTHY HOMES INITIATIVE

BENEFIT	#	COST PER UNIT ($)	YEARS POST-INTERVENTION			
			YEAR 1	YEAR 2	YEAR 3	TOTAL YEARS 1-3
Reduced Hospitalisations	9,744.58	4,751.58	46,302,151	43,681,274	41,208,749	131,192,176
Reduced Hospitalisation Severity	43,356.00	320.193	13,882,287	13,096,497	12,355,186	39,333,972
Reduced days absent	1,870	75	140,250	132,311	124,822	397,383
Reduced benefit income	52,182	200	10,436,400	9,845,660	9,288,359	29,570,419
Total			**70,761,089**	**66,755,744**	**62,977,117**	**200,493,951**

In total, the expected value of the social benefits in the first year after the HHI intervention is approximately $71 million. Given a total cost of $56 million, this means that in the first year alone, the value of the social benefits alone exceeds the programmatic cost. There are a number of assumptions underlying these estimates.

"The HHI assessor received a text from the mum "I'm so happy I could cry".

DISCUSSION

The results show that the HHI is making a difference to the health, education, and employment of the referred whānau. After adjusting for age and other bias where appropriate, we estimate that in the 12 months following the intervention period the average HHI whānau member had 0.065 fewer hospitalisations, children had 0.04 extra days in school and employment was increased by 4%. Over the 28,901 referrals already seen, this means there was a reduction of 9,744.58 hospitalisations and 1,870 extra days in school. These improvements are expected to result in a savings in direct medical costs of approximately $60 million in the earliest year after the intervention and $171 million in the earliest three years after the intervention. With the programmatic costs estimated at $56 million, the expected costs averted exceed the costs of the programme in the first year.

COMPARISON WITH HEALTH EFFECTS AS IDENTIFIED IN OTHER HOUSING INTERVENTION STUDIES

Comparative studies with which to compare the identified health gains attributable to the HHIs in this three-year evaluation analysis are difficult given the wide breadth of possible interventions carried out by HHI providers. However, one useful comparison is with the effect of insulation delivered under the EECA: Warm Up New Zealand scheme. This programme provided subsidised insulation for low-income families (qualified with a Community Services Card). In a sample of low-income families with children that received retrofitted insulation under this scheme, insulation delivered a reduction of 0.02 hospitalisations per person. Although the EECA scheme only delivered one intervention (insulation), it has been the subject of numerous analyses and this group of families (low-income with children) was its most cost-effective subgroup for health benefits at 15:1. Given the similarities with the HHI programme target populations, the significant improvement in health outcomes attributable to the HHI as identified in this analysis (e.g. a reduction of 0.065 hospitalisations per person) is a very complementary finding.

PERSISTENT EFFECT FOR HOSPITALISATIONS

One of the unanswered questions previously was “what are the longer-term outcomes post-intervention?”. In Table 2A we examined the most important outcome, reduced hospitalisations, and found no evidence that the effect is decreasing over time. On the contrary, the raw data indicated that the health benefit appeared to be growing over time, though this may be due to statistical chance.

STATISTICAL POWER AND THE IDI

With 75,858 individuals, this is a large detailed cross-sector dataset of community outcomes. This analysis is one of the first evaluations where the community organisations have gathered their own data and placed this on the IDI. The IDI is a real asset for examining the outcomes of large-scale projects, with the ability to track individuals and households across most government services for long periods of time. While our results are presented as statistical models estimating a theoretical effect on an infinite population, in reality this is much closer to a census where most people in the programme are measured.

LIMITATIONS OF ANALYSIS

COVID-19

The Covid-19 pandemic and the associated restrictions had a large effect on the function of New Zealand's medical, education and benefit systems. Unfortunately, these occurred in the later part of our observation period, and while they are adjusted for they add both increased variation to the model and potentially alter the results. Future analyses, when the impact of the disease has reduced and the sample is more evenly balanced pre- and post-pandemic, will be more accurate.

HOUSEHOLD ESTIMATION

The IDI features datasets from many agencies and organisations. To preserve individuals privacy each agency use a separate identifier for their data. StatNZ carry out record linkage across the datasets and then deidentify the data. Record linkage is done algorithmically using probabilistic record linkage where a unique identifier is not used across datasets and the resulting linkages may contain errors. In this report, household membership was estimated using the usual residence ID in the 2018 census which was subject to issues with response rate, particularly for families who were not able to access the digital census form online. Additionally, the use of the usual residence ID may not fully capture household members who live at more than one dwelling, including children in shared care.

COSTS AND BENEFITS OF THE PROGRAMME

Both the cost and benefits of the programme are incomplete underestimates. On the costs side, the costs of the intervention themselves are not included, these were largely borne by philanthropy or other government agencies. On the benefits side, we have only looked at a limited selection of easily costed benefits here and in our previous analysis, we showed that GP visits averted and pharmaceutical averted add another 8% to the observed saving from hospitalisation. We have not included the earnings from greater employment in the benefits, nor any reduction in ACC claims. Finally, the benefits are not measured beyond three years, but both the data and logic suggest they should persist for many years.

FUTURE RESEARCH

The HHIs are a broad, multifaceted, holistic programme in the community. This evaluation looks at only some of the possible outcomes of the programme. Now that the HHI data is available on the IDI we can investigate the broad range of possible outcomes in detail. Work has already begun in our cross-sector evaluation group to identify the most interesting outcomes and the detail needed to be of maximum impact from future policies.

The HHI providers have started to make more detailed information available in order to control for which specific interventions individual referrals have received.

CONCLUSION

The HHI is successfully working with low-income mostly Māori and Pacific whānau. The programme has made a major improvement to the health of the entire whānau, the education of the children, and the income of the working age adults. The HHI is highly effective, and this programme is an excellent return on government investment.

APPENDIX 1

EXTENDED ANALYSIS OF HOSPITALISATION NUMBERS

In addition to the primary analysis of hospitalisation numbers, how the effect of the HHI changed in the years post-intervention was also modelled. The average reduction was 13%, 24.4% and 28.7% in years 1, 2 and 3 after the intervention. However, none of these were statistically significantly greater than the overall estimate of 19.8%.

TABLE 1A

ANALYSIS OF HOSPITALISATION EFFECT OVER TIME

MODEL TERM	ODDS RATIO (95% CI)	P-VALUE
Age (all) (Age at middle of outcome year)	1.01 (1.01, 1.01)	<1:10,000
Age (children) (Adjustment for children <18 years)	0.989 (0.986, 0.992)	<1:10,000
Age (adults) (Adjustment for adults >50 years)	1.01 (1.00, 1.01)	0.00277
HHI Effect Year 1 (First-year post-intervention effect)	0.870 (0.847, 0.895)	<1:10,000
HHI Effect Year 2 (Second-year post-intervention effect)	0.756 (0.732, 0.781)	<1:10,000
HHI Effect Year 3 (Third-year post-intervention effect)	0.717 (0.688, 0.746)	<1:10,000
Covid-19 Adjustment (Correction for effect of Covid-19)	0.925 (0.898, 0.953)	<1:10,000

APPENDIX 2

HOSPITALISATION COST MODELLING

Hospitalisation cost modelling was conducted in parallel to the number of hospitalisations. A linear model was used with age and Covid-19 adjustments to model the total cost of hospitalisations each year for three years post-intervention. The effect attributed to HHI intervention resulted in a reduction of $320.19 in hospitalisation costs per outcome year in the three years post-intervention.

TABLE 2A

ANALYSIS OF HOSPITALISATION EFFECT OVER TIME ON HOSPITALISATION COSTS

MODEL TERM	ODDS RATIO (95% CI)	P-VALUE
Age (all) (Age at middle of outcome year)	11.68 (9.443, 13.91)	<1:10,000
Age (children) (Adjustment for children <18 years)	-17.22 (-22.47, -11.96)	<1:10,000
Age (adults) (Adjustment for adults >50 years)	16.54 (9.826, 23.25)	<1:10,000
HHI Effect (Effect attributed to intervention)	-320.1 (-356.4, -284.0)	<1:10,000
Covid-19 Adjustment (Correction for effect of Covid-19)	-31.40 (-77.20, 14.41)	0.17


Te Whatu Ora
Health New Zealand
Motu
Kāinga Ora
Homes and Communities
University of Otago
Te Whare Wānanga o Otāgo
New Zealand
Wellington
Te Tūāpapa Kura Kāinga
Ministry of Housing and Urban Development