

MEASURING PANDEMIC AND LOCKDOWN IMPACTS ON WELLBEING

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With the onset of the COVID-19 pandemic, New Zealand's official statistical agency (Stats NZ) moved quickly to supplement the quarterly Household Labour Force Survey with wellbeing measures from the General Social Survey. The first supplement (June 2020) began toward the end of a restrictive national lockdown. Subsequent quarterly surveys continued through a second lockdown for the Auckland region, enabling tests of regional lockdown impacts. Survey measures include questions on life satisfaction, health, income adequacy, social capital (trust), and loneliness. Published aggregated data indicate that life satisfaction, social capital, health, and financial wellbeing were each higher through the pandemic (in 2020) than prior to it, including for disadvantaged groups, but loneliness rose. Analysis of the individual-level data, confined to the within-pandemic period, however indicates that more restrictive lockdowns were associated both with reduced life satisfaction and greater loneliness, with differing impacts according to labor market and household status.

JEL Codes: I12, I31

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1. INTRODUCTION

Considerable scientific and policy attention is focused on impacts of the COVID-19 pandemic and accompanying lockdowns on health and wellbeing. Once this pandemic is over, the policy option of implementing a lockdown in the face of future pandemics remains. Hence it is critical to gather reliable data that can be used to derive lessons about whether a lockdown which is successful on the

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medical front can be applied in a form that does not cause societal wellbeing to decrease.

This study documents the actions of a national statistical agency, Statistics New Zealand (Stats NZ), in measuring wellbeing outcomes through the pandemic by initiating wellbeing supplements to the existing quarterly Household Labour Force Survey (HLFS). The wellbeing focus reflected the New Zealand government's focus on wellbeing as a guide for policy (Grimes, 2020a). After outlining Stats NZ's survey initiatives, the paper initially presents aggregated wellbeing figures using Stats NZ's official published data. The aggregated data are presented for both the most recent (2018) General Social Survey (GSS) prior to the pandemic and for the first three quarterly HLFS wellbeing supplements conducted through the pandemic in the June, September, and December quarters of 2020. The paper then turns to the individual-level survey data to test the effects of pandemic lockdowns within the first three quarters of the pandemic.

Stats NZ's aggregated figures challenge an emerging consensus from other studies of a trade-off between a lockdown's epidemiological merits and wellbeing (De Neve *et al.*, 2020; Miles *et al.*, 2020; Graham, 2020; Warren and Bordoloi, 2020; Brodeur *et al.*, 2021; Clark and Lepinteur, 2022). Overall life satisfaction, health status, income adequacy, and trust were all higher through the first three quarters of the pandemic (even in the face of national and regional lockdowns) than in the most recent prior GSS. However, there was also a loss of social contact exhibited through a rise in loneliness, a factor emphasized by Hamermesh (2020).

While providing useful descriptive quarterly information, the aggregated figures cannot disentangle the separate effects of lockdowns from those of the pandemic itself; nor do the quarterly dates correspond to actual lockdown dates. To address these issues, the analysis utilizes the individual-level data collected in the Stats NZ wellbeing supplements and leverages the timing and differing severity of regional lockdowns through 2020 to examine wellbeing impacts of lockdowns. Lockdown requirements differed in Auckland (the largest city) relative to the rest of New Zealand. Knowledge of survey timing and region for each respondent enables more precise analysis of the impacts of lockdowns on wellbeing outcomes than can be obtained by referring just to the aggregated data.

The results of the analysis indicate that, within the pandemic period, lockdowns of greater severity reduced respondents' levels of life satisfaction and raised the prevalence of loneliness. The conclusions with respect to loneliness are consistent with the aggregated statistics which show that loneliness was more prevalent through the pandemic than prior to it. However, the results for life satisfaction differ from those indicated by the aggregated data which indicate that life satisfaction (and a range of other wellbeing indicators) was higher through the pandemic than before. The concluding section offers potential explanations for these contrasting results.

The paper proceeds as follows. Section 2 provides background, briefly describing New Zealand's pandemic experience and policies. Section 3 examines challenges in conducting surveys of wellbeing during the pandemic. Section 4 outlines the study's methodology, while Section 5 presents results using both the aggregated quarterly data and using the individual-level repeat cross-section data from the three HLFS 2020 wellbeing supplements. Section 6 concludes with observations on measurement issues and on the trajectory of wellbeing outcomes through the pandemic.

2. NEW ZEALAND'S PANDEMIC EXPERIENCE AND POLICIES

New Zealand's lockdown, when adopted in March 2020, was the ninth most stringent of any country.¹ It was the most stringent among OECD countries. The decision to implement a stringent lockdown reflected an "elimination strategy" designed to return the country to zero active cases (Baker *et al.*, 2020; Jamieson, 2020; Jefferies *et al.*, 2020). This strategy is consistent with the analysis in Davies and Grimes (2020) that there is a positively valued real option available at the outset of a pandemic to attempt elimination. This option disappears if stringent early restrictions are not adopted since once infections have spread exponentially, elimination is no longer possible. If elimination is viewed as feasible by the population, there is an added advantage: Studies show that people are likely to change their behavior positively to contain a pandemic if they feel the threat can be countered, but are less likely to do so otherwise (Bavel *et al.*, 2020). Thus early stringent action may have both a positive psychological impact and increase the efficacy of lockdown in the attempted elimination phase.

A four-tier alert system was adopted in New Zealand starting on March 21, 2020. The strictest alert level (Level 4) is invoked when "sustained and intensive community transmission is occurring" with "widespread outbreaks." People are instructed to stay at home other than for essential personal movement, although safe recreational activity (e.g. walking in one's neighborhood) is allowed in the local area. Travel is severely limited, all gatherings are cancelled, and all public venues are closed. Businesses remain closed except for essential services (e.g. supermarkets, pharmacies, clinics, petrol stations, and lifeline utilities); all educational facilities are closed.

Level 3 is invoked when "multiple cases of community transmission are occurring and/or when there are multiple active clusters in multiple regions." People are instructed to stay home other than for essential personal movement, and physical distancing rules apply. Schools (years 1 to 10) and pre-schools can open, but only with limited capacity, and the expectation is that children will learn at home if possible. Similarly, people must work from home unless that is not possible. Businesses can open premises but cannot physically interact with customers. Low-risk local recreation activities are allowed, but public venues remain closed. Weddings and funerals are restricted to 10 people, and physical distancing and public health measures must be maintained. Inter-regional travel is highly limited (e.g. for critical workers) while at-risk people are encouraged to stay home where possible.

In Level 2, people can socialize in groups of up to 100, go shopping, and travel domestically, although physical distancing rules, and rules on wearing masks on public transport, apply. Businesses and public venues can open to the public if they follow public health guidance including physical distancing and record keeping; hospitality businesses must keep groups of customers separated, seated, and served by a single person. At-risk people are encouraged to stay at home or to take additional precautions when leaving home. Level 2+ is a step stronger than Level 2 in which extra restrictions are placed on travel and gatherings.

¹See: *Our World in Data* (<https://ourworldindata.org/covid-stringency-index>) based on the Containment and Health Index as at March 26, 2020 (Hale *et al.*, 2020).

TABLE 1
TIMELINE OF LOCKDOWNS, 2020

Date	New Zealand (NZ)	Auckland	Rest of NZ
March 21	Level 2		
March 23	Level 3		
March 26*	Level 4		
April 28*	Level 3		
May 14*	Level 2		
June 9*	Level 1		
August 12		Level 3	Level 2
August 31*		Level 2+	
September 22*			Level 1
September 24*		Level 2	
October 8*		Level 1	

*Legally, these moves occurred at 1 min to midnight on the previous day.

Source: <https://covid19.govt.nz/alert-system/>.

Under Level 1 (as in Levels 2 to 4), border crossings are strictly limited (with 2 week isolation periods in government-sanctioned facilities required upon entering the country); otherwise domestic life is normal. In practice, the major distinction in terms of people movement and interaction occurs between Levels 2 and 3 with everyday life being close to normal in Level 2; Levels 3 and 4 both impose intense restrictions.

Table 1 presents a timeline of key events regarding lockdowns in New Zealand through 2020. A differentiation is made between Auckland and the rest of New Zealand since Auckland experienced additional lockdown restrictions relative to the rest of the country from August to early October. Auckland is both the largest city in New Zealand (with approximately one-third of the country’s population) and the country’s main gateway city. Consequently, it has also experienced the bulk of COVID-19 infections and new incursions coming across the border. New Zealand’s first COVID-19 case was reported on 28 February 2020 with the move to Level 4 lockdown occurring within 1 month of the initial case.

Apple mobility trends data for New Zealand² show that domestic travel took a substantial time to return to pre-pandemic levels once relaxations in levels were announced. For instance, the data show that in July 2020, which was in Level 1 for the entire country, driving, transit, and walking were still at only 96 percent, 61 percent and 77 percent, respectively, of their pre-pandemic (February) levels. Thus even outside of legal lockdowns, social interaction was reduced compared with pre-lockdown norms.

Conventional economic and health measures indicate that at least a short-run trade-off occurred between economic and health outcomes. June 2020 quarter GDP fell 11 percent, the largest fall on record (but then rebounded by 14 percent in September). On the health front, New Zealand experienced a death rate from COVID-19 of just five deaths per million in 2020 compared with a world rate of 239.³

²Source: <https://covid19.apple.com/mobility>. Regional mobility data are not published.

³Source: *Our World in Data*: github.com/owid/covid-19-data/tree/master/public/data.

3. SURVEYING WELLBEING THROUGH THE PANDEMIC

While commonly reported, GDP outcomes and COVID-19 case rates and/or death rates do not provide a comprehensive guide to people's wellbeing outcomes. Here we follow recent wellbeing literature (e.g., Fujiwara and Dolan, 2016; Clark, 2018) by examining the trajectory of people's subjective wellbeing before, during, and after lockdown. The evaluative measure of subjective wellbeing included in the official surveys provides information on how people rate their life as a whole (Kahneman and Krueger, 2006). Following Hamermesh (2020) we also focus on outcomes for loneliness. The work by Bartscher *et al.* (2020) on the importance of social capital for improving adherence to lockdown restrictions (so increasing their likely success) prompts examination of two social capital variables relating to trust. Direct survey measures on health and the household's financial situation complete the suite of descriptive indicators presented here.

To have reliable indicators, we require well-sampled measures that are consistent before and during the pandemic. We utilize two official (Stats NZ) stratified sample surveys of the adult population that provide information on a range of wellbeing statistics. The pre-pandemic information is obtained from the 2018 General Social Survey (GSS) conducted from April 2018 to March 2019. The pandemic-period information is obtained from three quarterly waves of the Household Labour Force Survey (HLFS). GSS covers the adult population aged 15 years and above, while HLFS surveys the adult population 18 years and above. Stats NZ introduced GSS wellbeing questions into the HLFS from the June 2020 survey onward to track wellbeing through the pandemic. Person-weights are applied in calculating the descriptive statistics by Stats NZ. Table 2 provides information on each of the surveys.

For our purposes, the most important issue for the aggregated statistics, as shown in Table 2, is the timing of the June 2020 HLFS wellbeing supplement which began on May 7. This timing means that the June survey included 7 days of Level 3 lockdown, 26 days of Level 2 and 27 days of Level 1. People's responses to questions that do not have a specific timeframe attached (e.g. overall life satisfaction and trust questions) are likely to reflect a combination of experience during recent lockdown periods and the effects of coming out of lockdown. Questions that refer to a specific backward-looking period (such as loneliness, which refers to the last 4 weeks) will reflect a combination of experience over each of the four lockdown levels (noting that the country was in Level 4 lockdown until April 28).

The September 2020 quarter survey was also affected by lockdown, most severely so in the case of Auckland which underwent Level 3 lockdown for 19 days, Level 2+ for 24 days and Level 2 for 11 days; the remainder (38 days) was in Level 1. By contrast, the rest of New Zealand was in Level 2 for 41 days and Level 1 for 51 days. Interviewing continued (by phone) throughout the September quarter, so responses from both Auckland and the rest of the country were obtained consistently over this quarter.

In all the surveys other than June 2020, the response rates were at least 78 percent. The June 2020 response rate fell to 64.1 percent, in part reflecting restrictions on face-to-face interviewing during the lockdown; nevertheless, Stats NZ reports that bias in the June 2020 quarter was minimal given both the stratified

TABLE 2
STATS NZ WELLBEING SURVEYS

Survey	Dates Sampled	Sample Size Achieved	Response Rate	Issues
2018 GSS	April 2018–March 2019	~12,000	86.2%	• Nil
Jun-20 HLFS	May 7, 2020–July 5, 2020	10,370	64.1%	<ul style="list-style-type: none"> • Interviewing for HLFS began April 14 while NZ in alert Level 4. Hence no face-to-face interviewing was allowed. • First-time HLFS respondents are typically visited by a field interviewer but were instead sent a letter asking them to call Stats NZ to complete phone interview. • Interviewing for wellbeing supplement went live May 7. • Field interviewers able to resume house visits for the last 2 weeks of collection, beginning June 22. • Even though the achieved sample rate was lower than target, there was minimal bias present.
Sep-20 HLFS	July 5, 2020–October 4, 2020	12,905	82.4%	<ul style="list-style-type: none"> • Auckland entered Level 3 and the rest of NZ entered Level 2 on August 12. • Face-to-face interviewing halted for whole country on August 12. • Interviewers worked from home; no days of missed phone interviewing. • Outside of Auckland, interviewers returned to the field on September 8. • Face-to-face interviewing in Auckland resumed on September 15, excluding areas with COVID-19 cases.
Dec-20 HLFS	October 1, 2020–December 31, 2020	12,464	78.0%	• Nil

Source: Stats NZ information sheets from www.stats.govt.nz.

sampling of the survey and its weighting of responses so that the sample was representative of the population.⁴ Compared with several surveys conducted in New Zealand and elsewhere through the pandemic (and especially the lockdown) period, the June response rate is nevertheless commendable. Other New Zealand studies of wellbeing-related outcomes through the pandemic include Sibley *et al.* (2020), Every-Palmer *et al.* (2020), Prickett *et al.* (2020), Habibi *et al.* (2021) Fletcher *et al.* (2021), Rossouw *et al.* (2020) and Morrison *et al.* (2021). The first five of these studies are based on survey responses. The last two are based on sentiment analysis derived from Twitter.

Sibley *et al.*'s (2020) analysis uses the longitudinal New Zealand Attitudes and Values Survey (NZAVS). Using propensity score matching to match lockdown with pre-lockdown respondents, it found that the pandemic/lockdown group reported higher trust in others (including politicians) but also higher rates of mental distress. The achieved sample size was approximately 2000 (split evenly between pre-lockdown and during-lockdown). The response rate to the survey is not disclosed (either in the main article or in the supplementary materials) although the prior wave of NZAVS recorded a response rate of just 9.2 percent (Sibley *et al.*, 2020, online supplementary materials).

Every-Palmer *et al.* (2020) examined psychological wellbeing and related outcomes for respondents during Level 4 lockdown. They found poorer mental health outcomes than in baseline data from pre-pandemic surveys, but also found some positives including enjoying working from home and spending more time with family. The results were obtained from an online sample of 2010 responses derived from a panel of 300,000 potential respondents. Prickett *et al.*'s (2020) analysis was based on a sample of 2002 respondents (also from an online panel) to a survey conducted during Level 4 lockdown covering work-related, social, and wellbeing outcomes. It found little perceived change in household functioning through lockdown. Based on the same survey, Habibi *et al.* (2021) analyzed affective wellbeing for workers who lost their jobs through lockdown relative to those who retained their jobs, while Fletcher *et al.* (2021) analyzed job loss experiences of survey respondents during lockdown. Response rates for surveys based on online panels cannot be meaningfully calculated so the representativeness of each of these studies cannot be determined.

Instead of using surveys, Rossouw *et al.* (2020) and Morrison *et al.* (2021) analyze data from twitter feeds that are used to compile an index termed Gross National Happiness. Using data from 2020, the two studies indicate that average levels of happiness were significantly lowered after the onset of the pandemic but then recovered quickly. New Zealand has approximately 400,000 active Twitter users comprising 8.4 percent of the population; however, these users are clearly not representative of the overall population.

The difficulties of gauging wellbeing effects of lockdown are illustrated by these prior analyses. Bespoke surveys have had to be placed in the field with little preparation and with likely low (albeit unreported) response rates or use has been made of non-representative data such as tweets. Despite these drawbacks, a consensus from

⁴See: stats.govt.nz/information-releases/wellbeing-statistics-june-2020-quarter#about

the studies is that mental distress increased as a result of the pandemic and/or lockdown while other wellbeing outcomes may have been either unaffected or enhanced. These tentative conclusions set the scene for the analysis here which is based on much more representative data collected by Stats NZ, with the caveat that the Stats NZ data do not capture initial effects of the first lockdown.

4. METHODOLOGY

The six variables for which we report official aggregated descriptive statistics are (Stats NZ question descriptions shown in bold; summary question text shown in italics; the aggregated published answer categories are listed from “worst” to “best” shown in brackets):

Overall life satisfaction: Where zero is completely dissatisfied, and ten is completely satisfied, how do you feel about your life as a whole? (0-6, 7, 8, 9, 10).

Generalized trust: Trust held for people in New Zealand (0-4, 5-6, 7-8, 9-10).

Institutional trust: Trust held for parliament (0-4, 5-6, 7-8, 9-10).

Health: Self-rated general health status (*Fair/poor, Good, Very good, Excellent*).

Financial wellbeing: Adequacy of income to meet everyday needs (*Not enough money, Only just enough money, Enough money, More than enough money*).

Loneliness: Felt lonely in last four weeks (*Most/all of the time, Some of the time, A little of the time, None of the time*).

All six questions have responses that are ordinal in nature. The descriptive statistics are therefore presented here as cumulative distribution functions (CDFs). In interpreting the CDFs, we use the concept of “first order welfare dominance” introduced by Allison and Foster (2004): if the CDF is arranged from poorest to best outcome, and if the CDF of Series 2 lies everywhere below that of Series 1 up to the maximum category, then Series 2 displays first order welfare dominance over Series 1 (i.e. there are unambiguously smaller proportions of people in lower categories for Series 2 than for Series 1).

In our estimates based on the individual-level data, we analyze how lockdowns affected each of life satisfaction and loneliness. These two variables are chosen since the descriptive statistics show that loneliness displays quite different patterns to the other five variables. Given the ordinal nature of the dependent variables, ordered logit is used initially as the estimation technique for both life satisfaction and loneliness. The literature includes considerable analysis of whether life satisfaction can

be treated as if it were cardinal (Ferrer-i-Carbonell and Frijters, 2004; Graham *et al.*, 2018; Bond and Lang, 2019; Jenkins, 2020; Kaiser and Vendrik, 2020). We estimate the life satisfaction equation also with ordinary least squares (OLS) to check if similar patterns are found for the lockdown impacts as in the ordered logit estimates. Similarly, we estimate an OLS model for loneliness where loneliness is represented by a cardinal variable with five steps from “lonely none of the time” =1 to “lonely all of the time” =5. While this cardinal representation is analogous to that used for life satisfaction, there is not a strong supporting literature for the use of a cardinal loneliness variable. Accordingly, we also estimate a linear probability model with the loneliness scale collapsed to two categories (“lonely none of the time” =0, “lonely all/most/some/a little of the time” =1). We check each set of results for consistency with the ordered logit specification. All regressions use the repeated cross-section data from the June, September, and December HLFS wellbeing supplements, yielding a sample size of over 35,000.

For the life satisfaction equation (shown below in its OLS specification for clarity), we begin by estimating:

$$(1) \quad LifeSat_{it} = \alpha + \beta X_{it} + \sum_k \gamma_k Lockdown_{kit} + \theta_t + \varepsilon_{it}$$

where $LifeSat_{it}$ is overall life satisfaction for individual i in wave t , X_{it} is a vector of personal characteristics for i in t , $Lockdown_{kit}$ is a dummy variable for lockdown of level $k \in (1, 2, 2+, 3, 4)$ experienced by i in t (calculated according to region and survey timing for i), θ_t are wave fixed effects, α , β (a vector) and γ_k are coefficients and ε_{it} is the residual.

The γ_k coefficients measure the effects of each level of lockdown relative to Level 1, the base category. (Level 0, in which international border restrictions are absent, is not observed over the sample period.) The wave fixed effects control for seasonality and other aggregate time-varying factors that affect wellbeing but which are not included in the equation. We estimate (1) with and without wave fixed effects to test robustness of results given the potential collinearity between lockdown levels and wave fixed effects. The different lockdown timing and experience of Auckland effectively presents a difference-in-difference analysis when the wave fixed effects are retained. Ordered logit and linear probability models are specified analogously to (1).

In interpreting the results from each of these estimates, we are unable to observe whether lockdowns (of any level) have a wellbeing impact relative to a situation of no lockdowns since the HLFS data begin in the midst of the first national lockdown, and hence no “pre data” (Level 0) are available. We also have to be aware that lockdown levels are not independent of the degree of COVID-19 circulating in the community. For instance, Level 1 is adopted only when there are no active cases in the country. Level 2 has been adopted in circumstances when COVID-19 is present in other regions but not in the region under Level 2. Levels 3 and 4 indicate that COVID-19 is circulating, or may be circulating, in the region. One advantage of restricting attention to the 2020 data (rather than including 2021 when the delta variant became more widespread) is that Level 3 was adopted only (nationally and, later, in Auckland) when new case numbers were small: the maximum number of

new daily cases was 6 in the first Level 3 survey period (April 28–May 13 nationally), and 19 in the second Level 3 period (August 12–August 30 in Auckland). Thus, even during Level 3 episodes, residents had a negligible risk of catching COVID-19 and hence we do not control for regional COVID-19 infection rates. It is reasonable to infer that any effects we find relate to the effects of lockdowns rather than to COVID-19 risks *per se*. Nevertheless, we cannot rule out that risk perceptions may be regionally specific and correlated with that region's current COVID-19 experience. (Use of wellbeing data from subsequent surveys may be able to tease out differing impacts of regional lockdowns versus regional infection rates as COVID-19 became more prevalent in multiple regions with the onset of the omicron strain in 2022.)

5. RESULTS

5.1. Cumulative Distribution Functions (CDFs)

Figure 1 displays the CDFs (based on the aggregated Stats NZ figures) for each of the six series at the national level. They are presented as histograms for clarity. The CDFs are displayed for each of the three wellbeing supplements through 2020 and for the 2018 GSS. The GSS data are presented for the full year given that no seasonality is detectable for any of the variables when the GSS survey is disaggregated by quarter.⁵

Other than one very slight exception, each of the overall life satisfaction pandemic CDFs (Jun-20, Sep-20, and Dec-20) displays first order welfare dominance over the 2018 CDF. Hence adults' satisfaction with life during the pandemic was unambiguously higher than prior to it.⁶

The timing of the surveys is likely to have influenced these results. The June quarter survey started on May 7 so omitted the Level 4 lockdown period and was taken at a time when the elimination strategy was on a successful path. Even the reappearance of COVID-19 in Auckland in August 2020—with the return to Level 3 lockdown in that city—was quickly eliminated. Thus, for much of the period, respondents may have felt a sense of elation that the country had a successful elimination strategy in place. Furthermore, these experiences were at a time when the health and wellbeing situations in most other countries were grave.

The pandemic CDFs for each of generalized trust, institutional trust in parliament, self-rated health status and self-rated financial wellbeing also display first order welfare dominance over their 2018 distributions. The trust CDFs indicate higher social capital through the three pandemic quarters than in the prior year. The unambiguous improvement in self-rated health during a pandemic is in keeping

⁵For instance, the means of life satisfaction across each of the four quarters in the 2018 GSS are (with 95% CIs): June 7.58 (7.49, 7.67), September 7.58 (7.49, 7.67), December 7.65 (7.57, 7.74), March 7.62 (7.55, 7.69).

⁶Based on the Stats NZ published data, Grimes (2020b) reports that mean life satisfaction rose for 30 of 32 population sub-groups (and stayed constant for the other two sub-groups) for the initial pandemic quarters relative to pre-pandemic levels. The sub-groups, which were defined according to age, sex, labor force status, migrant status, ethnicity and region, included several groups regarded as disadvantaged.

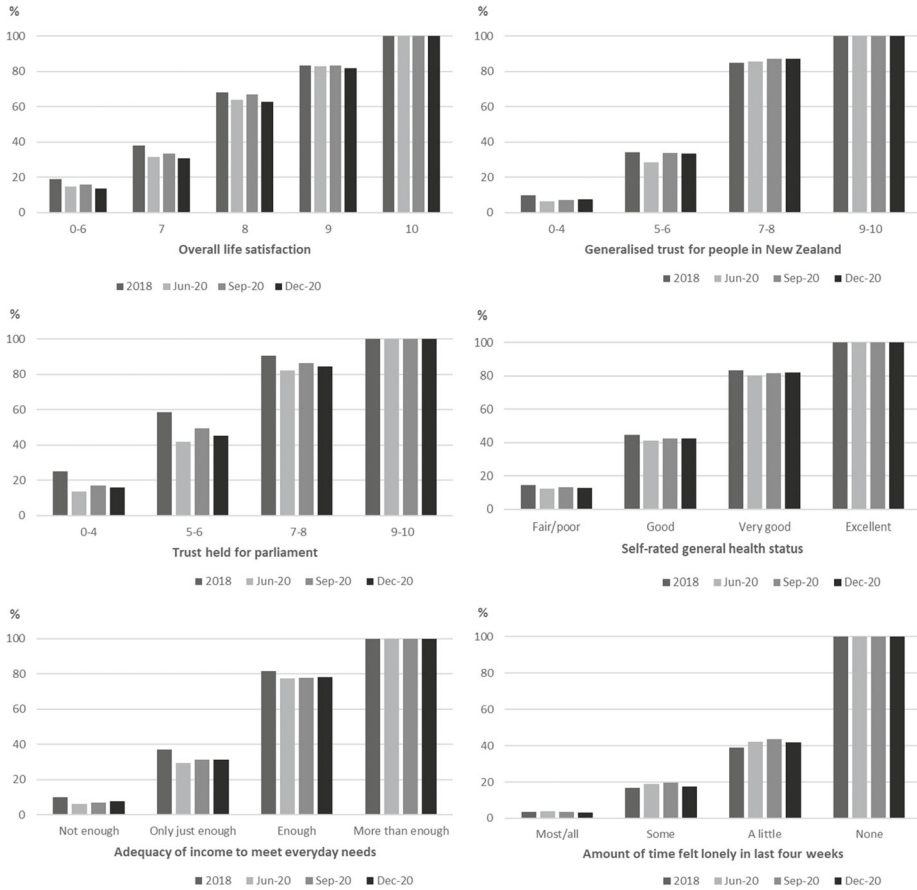


Figure 1. Cumulative Distribution Functions (CDFs).

Sources: Statistics NZ 2018 GSS; Jun-20, Sep-20 and Dec-20 HLFS surveys.

with other health statistics that show improvements in objective measures of health such as lower all-cause mortality (Ministry of Health, 2020) and lower rates of influenza.⁷ The unambiguous improvement in self-rated financial wellbeing, despite June quarter GDP suffering its largest ever fall, likely reflects the wage guarantee program implemented at the onset of the initial lockdown (financed by increased government debt) which helped to safeguard employment. The unemployment rate fell from 4.2 percent to 4.1 percent between March and June 2020, then rose to 5.3 percent in September, dropping to 4.8 percent in December 2020. By comparison, the unemployment rate peaked at 6.7 percent after the 2008 global financial crisis. The improved financial wellbeing may also reflect a reduced need for consumption expenditure during lockdown.

The loneliness CDFs stand out from the other five measures, showing the opposite trend for wellbeing. Other than one slight exception, the 2018 CDF

⁷<https://www.esr.cri.nz/our-services/consultancy/flu-surveillance-and-research>

displays first order welfare dominance over each of the pandemic CDFs. Thus loneliness was unambiguously higher (i.e. worse) through the course of the pandemic than prior to it. The loneliness results for all three pandemic quarters are consistent with reduced social interaction exhibited through the prolonged reduction in mobility trends highlighted earlier.

The aggregated figures presented in Figure 1 suggest that the pandemic and accompanying lockdowns did not result in reduced overall life satisfaction, trust, health, or financial situations relative to the prior year, while loneliness increased with the pandemic. However, the aggregated data do not coincide with exact lockdown dates and do not differentiate between regional lockdown experiences. The following analysis, using the individual-level survey data, addresses whether different levels of lockdown through 2020 were associated with changes in life satisfaction and loneliness. Outcomes for trust, health, and income adequacy are not explored further given their similar outcomes to life satisfaction; however, they are controlled for in the life satisfaction and loneliness regressions. The analysis utilizes both the survey date and the region of respondent to provide the necessary temporal and spatial detail required to assign lockdown levels to each survey response. As noted above, while the analysis compares wellbeing effects of lockdown Levels 1 to 3 within the pandemic period, it cannot be used to make comparisons with pre-pandemic outcomes or with outcomes under Level 4 lockdown given the timing of the surveys.

5.2. Individual-Level Analysis

We estimate the relationship of life satisfaction with lockdown levels plus a large array of control variables. All variables used in the analysis (plus means for each survey response option) are listed in Appendix Table A1 for each quarterly survey and for the full sample across the three surveys. Most responses are categorical, so the mean indicates the response proportion. Control variables cover a range of personal demographics (age, age-squared, sex, qualifications, household type, country of birth, recent migrant status, region, urban/rural status, ethnicity); labor market variables (labor force status, study status, usual weekly hours, whether weekly hours differed in past week (and why), preference for working more hours (and why), whether left job in last 3 months (and why), perceived job security); material wellbeing (self-rated income adequacy, and an 18 point deprivation scale that is related to the ELSI scale documented in Carver and Grimes, 2019); social capital (generalized trust, institutional trust in parliament); and self-rated health.

Three lockdown variables are included (for Levels 2, 2+, and 3, respectively) with Level 1 being the base category. These lockdown dummies reflect the situation for the respondent according to the date and region of the survey response. Initially, we present results with wave dummies excluded and then included. The inclusion of wave dummies leaves the results almost unchanged indicating that multicollinearity with lockdown dates is not material.

Table 3 shows the results (reported as odds ratios) from the ordered logit regression for life satisfaction. The first two columns provide a base specification with only the lockdown dummies included (and wave effects included in the second column); all control variables are included in the final two columns without and with wave fixed effects. The odds ratios across all four specifications indicate a strongly significant negative impact of Level 3 lockdown on life satisfaction with a lesser (albeit

TABLE 3
LIFE SATISFACTION—ORDERED LOGIT ESTIMATES (ODDS RATIOS)

Variables	(1)	(2)	(3)	(4)
Lockdown—level 2	0.910*** (0.024)	0.930** (0.028)	0.874*** (0.023)	0.897*** (0.027)
Lockdown—level 2+	0.810*** (0.055)	0.872* (0.062)	0.869* (0.069)	0.901 (0.074)
Lockdown—level 3	0.744*** (0.040)	0.765*** (0.043)	0.727*** (0.044)	0.748*** (0.047)
Wave—September 2020		0.909*** (0.026)		0.986 (0.029)
Wave—December 2020		1.004 (0.032)		1.049 (0.034)
Observations	35,610	35,610	35,610	35,610
Wave FE	No	Yes	No	Yes
Control variables	No	No	Yes	Yes
Pseudo- R^2	0.997	0.997	0.997	0.997

Notes: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

significant) effect of Level 2 lockdown; the Level 2+ effect is similar to that of Level 2 but is less precisely estimated (noting that only 2.6 percent of observations relate to Level 2+).

Table 4 presents the corresponding information using OLS estimation in place of ordered logit. The pattern of results is very similar to that in Table 3. Given the strong similarity, and the greater ease of interpreting the OLS results, subsequent interpretation is based on the OLS specification. The effect of Level 3 lockdown (relative to Level 1) is a drop in life satisfaction of approximately 0.2 of a point (on a 0–10 scale). This drop compares with the sample mean and standard deviation of 7.8 and 1.7, respectively; thus the drop in life satisfaction represents approximately 12 percent of a standard deviation. Based on the estimates for the control variables, the drop is similar in magnitude to the effect of having “only just enough money” compared with having “enough money” and is approximately two-thirds of the effect of being unemployed relative to being employed. Complete results for the full OLS specification [column (4)] are included in the online appendix (Appendix S1).

Noting, from Table 1, that the first Level 3 lockdown in the survey period applied nationally while the second applied only to Auckland, we tested whether the Level 3 lockdown coefficient differed between the two episodes, finding no statistically significant difference between them. Thus we cannot reject that the regional and national lockdown impacts are identical. The negative impacts of being in Level 3 (in which everyday life is highly restricted) are approximately thrice the size of being in Level 2 (in which life is virtually normal for most everyday activities).

The results in Tables 3 and 4 are notable for their robustness to the inclusion of a wide range of personal characteristics, implying that the overall negative effects of lockdown are due to factors other than income, health, social trust, etc. (Restricted mobility may be a candidate, though we cannot test for this explicitly.) Nevertheless, it remains possible that lockdown effects are heterogeneous across individuals, being mediated according to personal circumstances such as the direct impacts of COVID-19 on a person’s livelihood. To investigate this potential heterogeneity, we have extended the OLS estimates to include interaction terms between personal

TABLE 4
LIFE SATISFACTION—OLS ESTIMATES

Variables	(1)	(2)	(3)	(4)
Lockdown—level 2	-0.076*** (0.024)	-0.052* (0.027)	-0.097*** (0.021)	-0.074*** (0.024)
Lockdown—level 2+	-0.171*** (0.062)	-0.096 (0.065)	-0.128** (0.060)	-0.091 (0.063)
Lockdown—level 3	-0.247*** (0.053)	-0.218*** (0.054)	-0.235*** (0.050)	-0.209*** (0.051)
Wave—September 2020		-0.092*** (0.026)		-0.021 (0.023)
Wave—December 2020		0.011 (0.029)		0.039 (0.025)
Observations	35,610	35,610	35,610	35,610
Wave FE	No	Yes	No	Yes
Control variables	No	No	Yes	Yes
R ²	0.001	0.002	0.259	0.259

Notes: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(labor market and household) characteristics and the Level 3 lockdown dummy. These estimates indicate whether Level 3 lockdown has differential effects depending on a person’s labor market status or household status. Given the large number of characteristics included as controls in the regression, each potential interaction is included by itself (together with the other categories from that survey question). Several findings are of interest (based on interaction terms that are significant at the 10 percent level).

Level 3 lockdown is estimated to be positive for people who are unemployed with a rise in the life satisfaction for the unemployed of 0.24 points. Similarly, those who wish to work more hours but are not doing so because there is “not enough work available” have a rise in life satisfaction in Level 3 of 0.13 points. These results are consistent with prior findings that the negative effect on wellbeing of being unemployed is lower when regional unemployment is high (Clark, 2018); thus there may be reduced stigma for those who are out of work when lockdown is severe and others are not visibly working. People who are working fewer hours than normal “because of COVID-19” experience virtually no change in life satisfaction with Level 3 lockdown, potentially indicating an improvement in work-life balance as hours worked are reduced. People who report having “only just enough money” are also insulated from the negative effects of lockdown with an estimated 0.12 point improvement in their life satisfaction; financial commitments (e.g. for children’s activities) are likely to have been reduced with lockdown potentially improving this group’s financial situation.

While some disadvantaged groups therefore appear to have benefitted from lockdown, sole parents with dependent children (and others) in the household suffered disproportionately through Level 3, having more than a full point (1.03) drop in life satisfaction. A drop of this magnitude is almost twice the effect of not having enough income (relative to having enough money), indicating that these sole parent households suffered substantially through lockdown.

Tables 5 and 6 present analogous results to Tables 3 and 4 with loneliness as the dependent variable. Table 5 presents results of the ordered logit regression. Table 6

TABLE 5
LONELINESS—ORDERED LOGIT ESTIMATES (ODDS RATIOS)

Variables	(1)	(2)	(3)	(4)
Lockdown—level 2	1.107*** (0.032)	1.110*** (0.036)	1.118*** (0.034)	1.121*** (0.038)
Lockdown—level 2+	1.088 (0.086)	1.059 (0.086)	1.077 (0.096)	1.055 (0.097)
Lockdown—level 3	1.290*** (0.080)	1.290*** (0.082)	1.348*** (0.090)	1.347*** (0.093)
Wave—September 2020		1.056* (0.033)		1.043 (0.035)
Wave—December 2020		1.028 (0.036)		1.026 (0.038)
Observations	35,625	35,625	35,625	35,625
Wave FE	No	Yes	No	Yes
Control variables	No	No	Yes	Yes
Pseudo- R^2	0.997	0.997	0.997	0.997

Notes: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

presents results from both the cardinal OLS specification (with loneliness on a 1 to 5 scale) and the linear probability model. In the latter, loneliness is dichotomized into a dummy variable reflecting the CDF (Figure 1) in which over half of respondents in each survey answer that they are lonely none of the time. The pattern of results for the impact of lockdown levels is very similar across all three estimation techniques. Complete results for the full specification [column (4)] of both the cardinal model and the linear probability model are included in the online appendix (Appendix S1).

Based on the cardinal model, Level 3 lockdown is associated with a 0.12 rise in loneliness (on a 1-5 scale) relative to being in Level 1. This rise compares with a sample mean and standard deviation of 1.7 and 0.9, respectively; thus the rise in loneliness represents 13 percent of a standard deviation. The linear probability model indicates that (relative to being in Level 1), Level 3 lockdown is associated with an increase in the probability of being lonely of 6.1 percent; this effect is more than twice that of being in Level 2. The increase in the probability of being lonely associated with Level 3 is larger than that associated with being a new migrant (4.9 percent) and is approximately half that associated with being a sole parent with dependent children (12.6 percent) relative to being in a couple-only household.

As with life satisfaction, we have interacted labor market and household status variables with Level 3 lockdown to test if loneliness impacts differ according to personal characteristics. These tests indicate heterogeneity of effects across several job-related variables. In particular, Level 3 lockdown was associated with reduced loneliness for: people who left their last job due to COVID-19 reasons, people who work fewer hours than they would like because of a lack of available childcare, and people who feel they are almost certain to lose their job. Each of these groups may have experienced an improvement in work-life balance as a result of lockdown, contributing to a reduction in the probability of loneliness.

At the household level, relative to a couple-only household, couples who cohabit with others are estimated to have reduced loneliness through lockdown.

TABLE 6
LONELINESS—OLS MODELS

Cardinal Model (1–5 scale)				
Variables	(1)	(2)	(3)	(4)
Lockdown—level 2	0.043*** (0.013)	0.040*** (0.015)	0.043*** (0.012)	0.042*** (0.014)
Lockdown—level 2+	0.049 (0.036)	0.037 (0.037)	0.037 (0.036)	0.030 (0.037)
Lockdown—level 3	0.122*** (0.030)	0.119*** (0.031)	0.123*** (0.029)	0.121*** (0.029)
Wave—September 2020		0.017 (0.014)		0.009 (0.013)
Wave—December 2020		0.002 (0.016)		0.002 (0.015)
Observations	35,625	35,625	35,625	35,625
Wave FE	No	Yes	No	Yes
Control variables	No	No	Yes	Yes
R ²	0.001	0.001	0.140	0.140
Linear Probability Model				
Variables	(1)	(2)	(3)	(4)
Lockdown—level 2	0.024*** (0.007)	0.027*** (0.008)	0.023*** (0.007)	0.026*** (0.008)
Lockdown—level 2+	0.011 (0.019)	0.005 (0.020)	0.008 (0.020)	0.005 (0.020)
Lockdown—level 3	0.057*** (0.016)	0.059*** (0.016)	0.058*** (0.016)	0.061*** (0.016)
Wave—September 2020		0.015* (0.008)		0.013* (0.008)
Wave—December 2020		0.012 (0.009)		0.013 (0.008)
Observations	35,625	35,625	35,625	35,625
Wave FE	No	Yes	No	Yes
Control variables	No	No	Yes	Yes
R ²	0.001	0.001	0.109	0.109

Notes: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

However, a sole parent household with adult children present in the house experienced an increased probability of loneliness.

One further interaction that is tested is whether people with high degrees of loneliness suffer more in terms of life satisfaction through Level 3 lockdown. To test this hypothesis, the loneliness variable is added to the life satisfaction OLS regression (with the base category being lonely “none of the time”) together with the interaction of each loneliness category with Level 3 lockdown. None of the interaction terms is significant at the 5 percent level, but the interaction of being lonely “all of the time” with the lockdown dummy is significant at the 10 percent level. While the estimated coefficient (−1.61) indicates that the life satisfaction of these people is particularly hard-hit by lockdown, the descriptive statistics show that this group forms a very small proportion (approximately 0.8 percent) of the population.

The results for both life satisfaction and loneliness show that Level 3 lockdown is associated with an overall reduction in wellbeing (measured by each of life satisfaction and loneliness) relative to that experienced through lower lockdown

levels. However, the effects are heterogeneous across groups. Importantly, poorer outcomes are not necessarily correlated with prior disadvantage. For instance, the unemployed and people who find it hard to access childcare have improvements in their wellbeing with lockdown. We stress that each of these results is conditional on analysis within an ongoing pandemic and so cannot be compared with a situation in which no pandemic exists.

6. CONCLUSIONS

One consequence of the New Zealand government's policy focus on wellbeing is that Stats NZ moved quickly after the onset of the pandemic to supplement a quarterly population survey to include a range of wellbeing measures commensurate with prior population surveys. Specifically, it incorporated questions regularly asked in the biennial General Social Survey into the quarterly Household Labour Force Survey starting in the June 2020 quarter. Surveying began in the field within 10 weeks of the first COVID-19 case being recorded in the country. While the wellbeing survey only began after the height of initial lockdown, it still covered a period of intense (Level 3) lockdown. The inclusion of wellbeing questions in the HLFS that were identical to those in the GSS has enabled policymakers and researchers to track the dynamics of wellbeing through the pandemic using more reliable data than obtained from bespoke surveys or non-representative data sources.

The aggregated Stats NZ quarterly data indicate that life satisfaction and other wellbeing indicators were higher (in aggregate and for a range of population sub-groups) through the first three quarters of the pandemic than prior to the pandemic's start. The surveys include periods when all or parts of New Zealand were in intensive (Level 3) lockdowns. However, the 2020 surveys do not include the Level 4 lockdown period, which preceded the start of the survey. The survey began at a time when the country was successfully eliminating the first wave of COVID-19, which may have been associated with some euphoria, but also includes the second wave experienced in Auckland in August 2020. The finding from the aggregated data that several measures of wellbeing were higher through the first three quarters of the pandemic than prior to it suggests that a short-lived, effective lockdown need not have a prolonged negative impact on population wellbeing, even for disadvantaged groups. However, the aggregated data also show that loneliness increased through the pandemic relative to prior levels.

Once we turn from the aggregated data to analysis of the individual-level data, with attention paid to (regionally-specific) lockdown dates, a more nuanced interpretation of lockdown ensues. Within the pandemic period, a more restrictive lockdown is associated with increased loneliness and a reduced level of overall life satisfaction; however, these effects are not homogeneous. For instance, there are positive lockdown impacts on life satisfaction for people who are unemployed or seeking more hours of work, consistent with previous findings of peer effects relating to the stigma of unemployment. Certain groups of sole parents, however, are likely to experience a substantially greater reduction in life satisfaction and a substantially greater increase in loneliness as a result of an intense lockdown than are couple households.

The findings of negative wellbeing effects of a restrictive lockdown are conditioned on being limited to analysis of within-pandemic experiences. The higher

levels of wellbeing through the first year of the pandemic relative to the year prior level, as indicated by the aggregated measures, may potentially be reconciled against the within-pandemic results in two ways. First, it may be that the first-order effect of government actions to seek (and, for a time, achieve) elimination of COVID-19 resulted in higher wellbeing that then fluctuated around this new higher level as restrictions intensified and loosened through the pandemic period. Second, the wellbeing rise from 2018/2019 to 2020 may have been the result of factors unrelated to the pandemic. The available data cannot differentiate between these two explanations.

The analysis conducted here is only made possible by Stats NZ's decision to undertake rigorous surveying of the adult population almost immediately after the pandemic began. As well as providing lessons regarding wellbeing impacts of lockdown, Stats NZ's actions may have lessons for other national statistical agencies in deftly instituting a wellbeing supplement to an existing quarterly statistical survey. With the continuation of the HLFS wellbeing supplements through 2021 (and beyond), the resulting data afford policymakers and researchers invaluable opportunities to assess the effects of lockdowns beyond 2020 and to assess the merits of alternative policy options when the next pandemic occurs.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article at the publisher's web site:

Table A.1. Variables, response options, and descriptive statistics*