WORKING PAPER / **12 / 04**

Impact of the Future Focus changes to Sickness Benefit medical certificates: Technical Report

APRIL 2012

MINISTRY OF SOCIAL DEVELOPMENT
Te Manatū Whakahiato Ora

PREPARED BY
Centre for Social Research and Evaluation

CENTRE FOR SOCIAL RESEARCH AND EVALUATION

AUTHOR

Marc de Boer, Principal Analyst, Ministry of Social Development

DISCLAIMER

The views and interpretations in this report are those of the researcher and are not the official position of the Ministry of Social Development.

Readers should note that this report was prepared for internal use only, and has not been through the Ministry's full publication quality assurance process. MSD is publishing this research as it may be of value and interest to the social services research community and others. The report has been edited and proof read, but the layout and content has not been reviewed or updated since the report was finalised.

SUGGESTED CITATION

MSD (2012) *Impact of the Future Focus changes to Sickness Benefit medical certificates: Technical report*, Centre for Social Research and Evaluation, Ministry of Social Development, Wellington.

DATE OF PUBLICATION

This report was completed in April 2012, and published in the MSD Research Archive website in September 2019.

ISBN

Online 978-0-9951240-0-4

Contents

List of tables

List of figures

Summary

Introduction

In the report, we summarise the impact of introducing an additional medical certificate at eight weeks after grant on the time Sickness Benefit (SB) clients remain on benefit.

Eight-week medical certificate

To receive an SB a client must submit a medical certificate at regular intervals after grant. Under the Future Focus package the frequency of medical certificate was changed (**Error! R eference source not found.**). Before May 2011, clients' initial medical certificate expired at four weeks, after which each subsequent medical certificate expired at 13-week intervals. After May 2011, the first medical certificate expired after four weeks instead of 13. As a result, clients need to complete their second medical certificate at eight weeks rather than at 17 weeks.

Table 1: Anticipated interval between medical certificate after grant of SB

	Pre May 2011		Post May 2011	
	Expiry interval	Weeks after grant	Expiry interval	Weeks after grant
1	After 4 weeks	4	After 4 weeks	4
2	After 13 weeks	17	After 4 weeks	8
3+	After 13 weeks	30	After 13 weeks	21

Main findings

These findings cover the first 28 months after the introduction of the eight-week medical certificate to the end of December 2012.

Eight-week medical certificate made no difference to the time clients spent on main benefit

Error! Reference source not found. shows the proportion of SB clients on main benefit after g rant. The chart has three lines:

- **Observed**: the actual outcomes of SB clients granted benefit after May 2011 and who were required to complete an eight-week medical certificate.
- **Modelled**: the estimated proportion of affected clients on main benefit based on a survival model.
- **Counterfactual**: the estimated proportion of affected clients on main benefit if they had not been required to complete an eight-week medical certificate. In other words, what would their outcomes have been under the medical certificate process in place before May 2011?

Comparing the observed and modelled lines informs us of how well we could model the observed pattern of benefit receipt. We conclude that the model is satisfactory since the observed lies within the confidence interval of the modelled line.

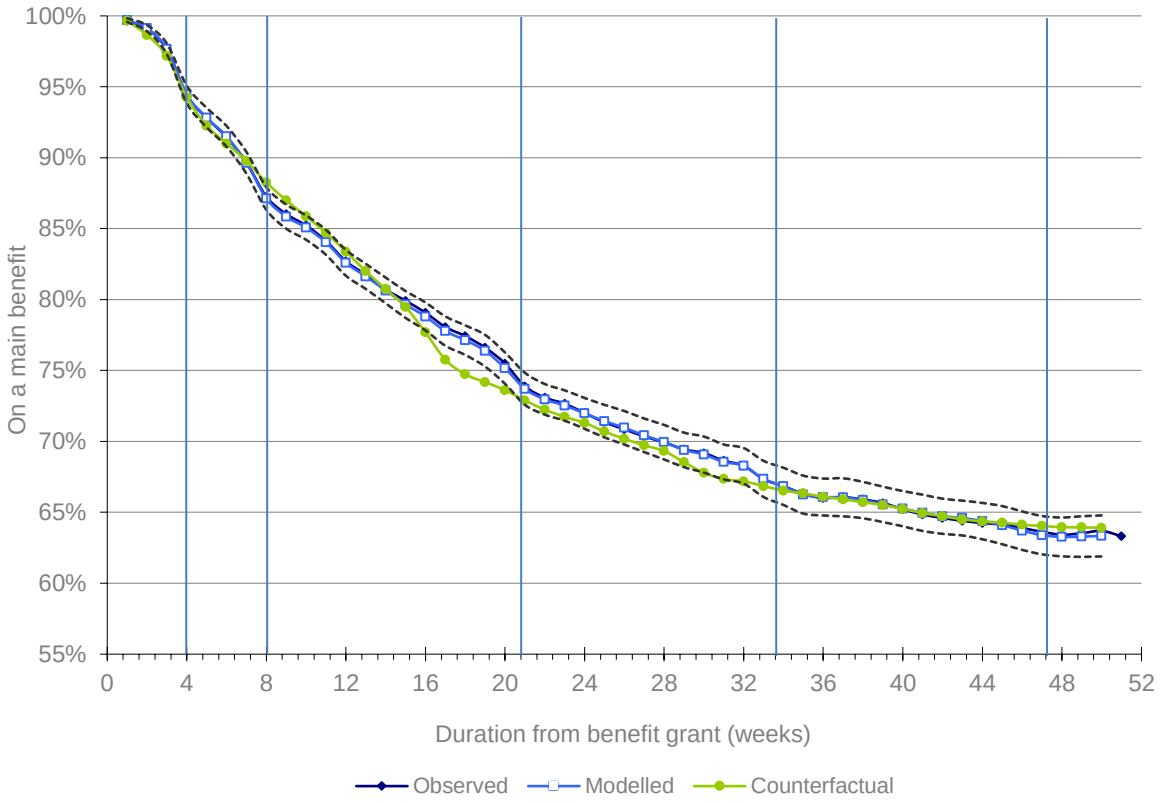
The comparison between the modelled and counterfactual line tells us the impact of the eight-week medical process on benefit receipt. The introduction of the additional medical certificate had two impacts.

1. There was a modest decrease in the proportion of clients on benefit after the eight-week medical certificate expiry and this lasts until about week 15 after grant (see Figure 1).

2. Because the subsequent medical certificate now occurs at week 21 instead of week 17, we see a relative increase in the proportion of affected clients on main benefit between weeks 17 and 21 after grant. We see a similar pattern between weeks 30 and 34.

These two impacts cancel each other out. Overall, there was no substantial change in the average time that clients spend on main benefit with the introduction of the eight-week medical certificate.

Figure 1: Impact of change in medical certificate process on the probability of being on main benefit



a: The dotted lines indicate the 95 percent confidence interval for the modelled line.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics)[1].

Eight-week medical certificate process has increased benefit administration costs

Because the introduction of the eight-week medical certificate did not alter the overall time clients spent on SB, the policy change has increased the average number of medical certificates clients need to complete.

With the eight-week medical certificate, clients complete an average of 3.3 medical certificates over the first 52 weeks after grant.[2] We estimate that without the eight-week medical certificate, clients would have completed an average of 2.7 (±0.3) medical certificates. Therefore, the introduction of the eight-week medical certificate has increased the average number of medical certificates by 0.7 (±0.1).

[1] BDD = Benefit Dynamics Dataset; CSRE = Centre for Social Research and Evaluation; MSD = Ministry of Social Development

[2] This excludes any medical certificate completed if they exit and then return to SB over this period.

The increased number of medical certificates would impose costs to:

- Work and Income in additional administration
- clients in time taken to obtain these certificates
- primary health care providers in issuing them.

Conclusion

The introduction of the eight-week medical certificate achieved only a modest reduction in clients on benefit at eight weeks. However, because subsequent medical certificates are now required later in the benefit spell (eg at 21 weeks instead of 17), clients who exit with medical certificate expiry are doing so later in their spell. These two impacts cancel each other out, and for this reason we conclude the eight-week medical certificate has been unsuccessful in reducing the overall time clients remain on benefit. Instead, the introduction of the additional medical certificate has increased the cost of benefit administration to Work and Income, clients and the health system.

Analysis

This section presents the analysis of the estimated impact of the May 2011 medical certificate change. We divide the analysis into the following parts:

- outline of how the reapplication process is expected to operate
- brief discussion of the expected impact of the reapplication process on benefit outcomes
- analysis of whether the reapplication process altered the time that clients spend:
    - on SB
    - on any main benefits
    - off main benefit when they exit
- estimation of the overall change in the time on benefit.

The technical notes section (page 26) covers, in more detail, the methodology and modelling that underpin the analysis presented here.

Medical certificate process

Medical reassessments determine whether a person's condition or work capacity has changed. The aim of the reassessment is to make sure people are receiving the right benefit, and to identify the service approach that is most likely to lead to a return to work, when this is suitable. Reassessments involve the client providing medical evidence of their condition through a medical certificate. It is the responsibility of the client to provide these medical certificates at regular intervals after grant of SB. Similarly, the client has to bear the cost of obtaining a medical certificate from their medical practitioner (normally a general practitioner).

Future Focus changes

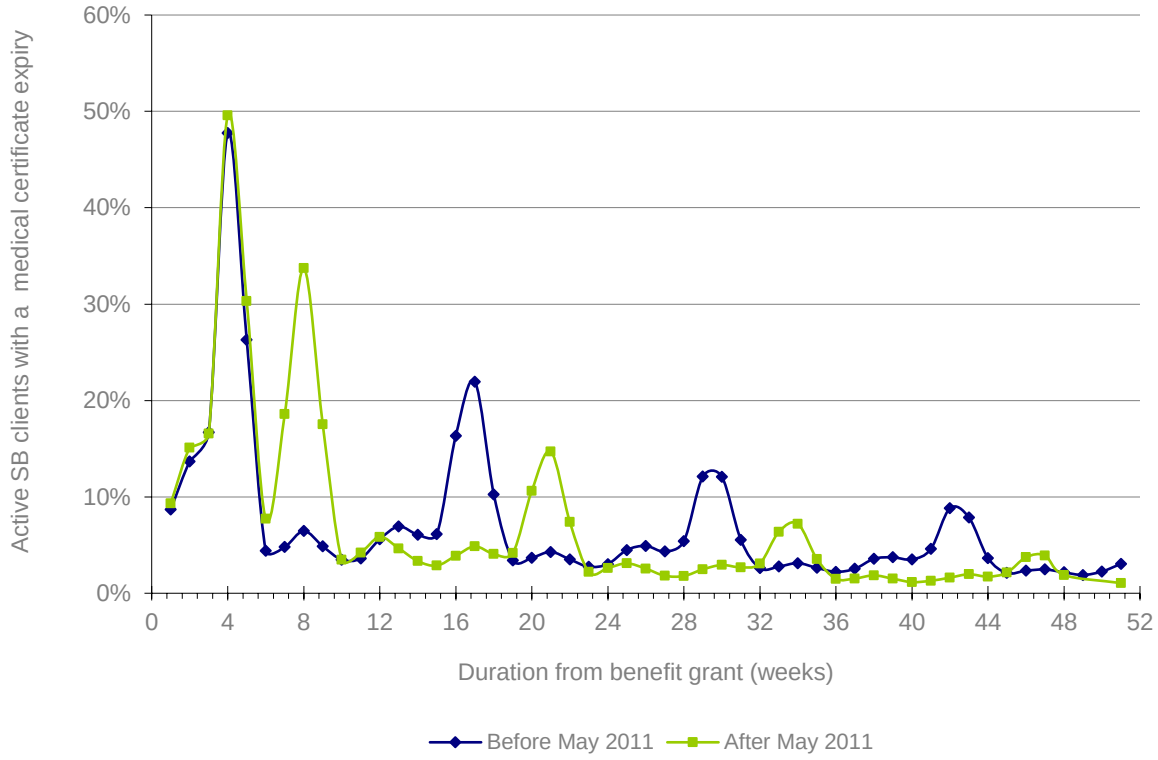
Before the Future Focus changes from May 2011, the interval between the first and second medical certificate expiry was 13 weeks (Table 2). Specifically, a client needs to submit the first medical certificate at four weeks and the second at 17 weeks. After May 2011, the expiry for the first medical certificate decreased from 13 to four weeks. As a result, the second medical certificate occurred at eight weeks instead of 17.

Table 2: Anticipated interval between medical certificate after grant of SB

	Pre May 2011		Post May 2011	
	Expiry interval	Weeks after grant	Expiry interval	Weeks after grant
1	After 4 weeks	4	After 4 weeks	4
2	After 13 weeks	17	After 4 weeks	8
3+	After 13 weeks	30	After 13 weeks	21

Figure 2 shows the impact of the introduction of the eight-week medical certificate on the frequency of when clients are required to submit a medical certificate. The chart shows the proportion of SB clients with a medical certificate expiry date each week after grant. The first observation is that medical certificate expiry dates do not only fall on the weeks outlined in Table 2 above. This spread in medical certificate expiry dates occurs where case managers have chosen to vary the time until the next medical certificate expiry date. Such variations could occur because the medical certificate indicates the client's medical status will change before or after the standard review interval.

Figure 2: Proportion of SB clients with a medical certificate expiry by benefit duration



Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Error! Reference source not found. clearly shows the introduction of a second four-week medical c ertificate expiry, with an increase in the proportion of clients with a medical certificate at around eight weeks after grant for those commencing benefit after May 2011. The other consequence of the change in medical certificate frequency is that this shifts the subsequent peaks in medical certificate expiries (eg from 16-17 weeks to 21-23 weeks).

Impact of the eight-week medical certificate

Because medical certificate expiry occurs at a predetermined period on a client's benefit spell, we can examine how clients respond to the reapplication process compared to previous cohorts of clients. The following section examines the impact of the eight-week medical certificate's introduction on three benefit outcomes:

- duration on current SB spell
- duration on current main benefit spell
- time spent off main benefit.

For each we present descriptive analysis of the outcome by client cohort before summarising the duration models used to estimate the impact of the reapplication process.

Duration on sickness benefit

The first outcome we examine is the time clients spend on their current SB spell. We anticipate that increased frequency of medical certificate expiry at the start of the spell will shift the rate of exit from the 17-week period towards the eight-week period.

Definition of duration on sickness benefit

In this analysis, we combine any consecutive spells of SB into a single spell. Any change in partner status has no effect on spell duration, so a client changing from single to a partner on SB will not end their current spell. If there is more than one day between SB spells, these are treated as a new benefit spell. Spells reflect the most current version of the administrative data and therefore include retrospective changes to spell history.

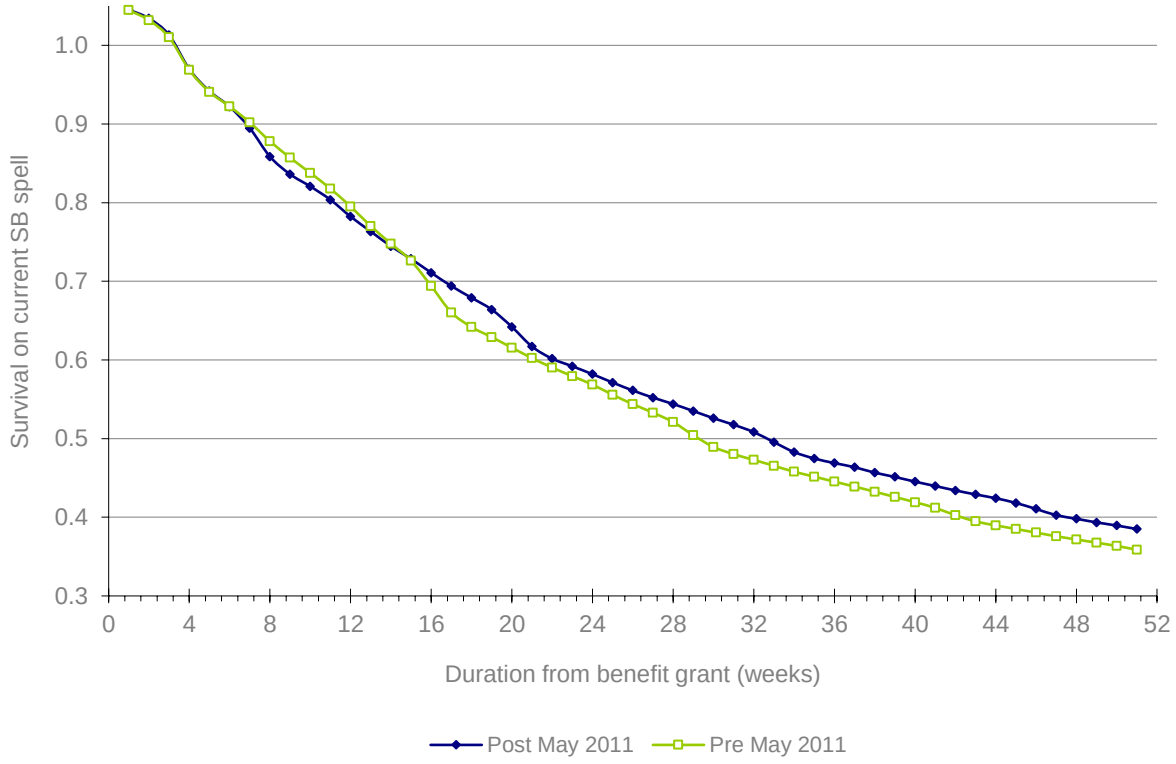
Observed duration on sickness benefit

For this analysis, we selected all clients granted SB from 1 January 2006. Figure 2 shows the survival on SB for the selected clients. We show the survival curves according to whether the client commenced before or after the introduction of the eight-week medical certificate in May 2011.

The introduction of the eight-week medical certificate resulted in lower survival between seven and 15 weeks after grant. At 16 weeks, those who commenced before May 2011 had their second medical certificate expiry and began to increase their rate of exit between weeks 16 and 18. At the end of 52 weeks the survival periods on SB are quite similar.

This descriptive analysis indicates that the change in frequency of expiry dates has altered the time that clients spend on SB. At the end of the outcome period (one year), clients who commenced after the policy change have a slightly higher probability of remaining on SB than previously. However, we cannot attribute this to the change in medical certificate frequency since we have not accounted for the impact of other factors on the time clients remain on benefit, specifically the economic downturn from 2009 onwards.

Figure 3: Survival curve for time on current sickness related benefit



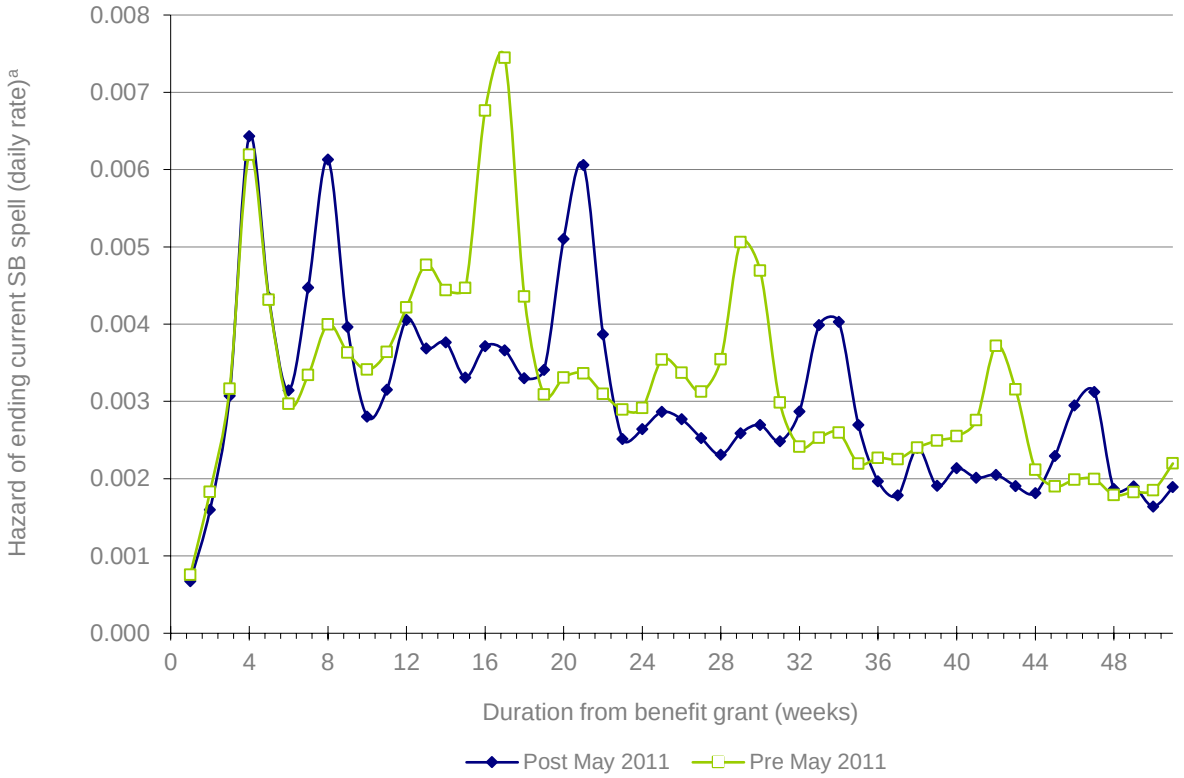
a: Proportion who remain on their current sickness-related benefit. That is, they have not exited main benefit or transferred to a benefit other than SB.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

To show the impact of the change in the medical certificate process more clearly, we convert survival curves into hazard rates (Figure 4). The hazard rate is the probability a client will end their SB spell in each day, given they have remained on benefit up to that day.[3] In Figure 4 the pattern in baseline hazard closely follows the pattern in medical certificate expiry dates (see Figure 1). Therefore, at around four weeks we see a sharp increase in hazard of ending SB spell. For those starting their spell after May 2011, we also see an increase at eight weeks that corresponds to the new medical certificate expiry at eight weeks after grant. Finally, the peak at 17 weeks for pre May 2011 and 21 weeks for post May 2011 corresponds to the first 13-week medical certificate expiry period.

[3] In the figures, the hazard rate is given as the daily average over the interval.

Figure 4: Hazard rates for duration on current SB spell



a: Probability of exiting their current SB spell in the interval through either cancelling benefit entirely or transferring to a benefit other than SB.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Impact of the reapplication process on ending sickness benefit spell

The descriptive analysis shows the timing of medical certificate expiry dates has a strong influence on the hazard of ending an SB spell. To quantify this impact we used duration modelling to separate the impact of the change in the medical certificate process from other factors that influence clients' duration on benefit. The technical notes section provides detail on this modelling work (see page 36).

Table 3 summarises the model estimates for each medical certificate expiry after grant. The model involved an interaction between the medical certificate expiry before and after May 2011 as well as a change in the baseline hazard.

Because medical certificate expiry has such a strong influence on the hazard of ending an SB spell, the main impact of the change in frequency in medical certificates is on the baseline hazard itself. From **Error! Reference source not found.** the most notable change is the shift in the baseline h azard before and after May 2011 at eight, 17 and 21-24 weeks. By comparison, the parameter estimates for the count of medical certificate expiry are very similar before and after May 2011. This is a surprising result since the duration between medical certificate 1 and medical certificate 2 has changed from 13 weeks to four weeks after May 2011. Intuitively we expected the parameter for medical certificate 2 to be substantially lower after May 2011.

Table 3: Parameter estimate for the medical certificate process on the hazard of ending current spell on SB

		Interaction with Future Focus change	
Variable	Class	Pre May 2011	Post May 2011
Order of medical certificate	Med Cert 01	*** 1.80	*** 1.97
	Med Cert 02	*** 2.33	*** 2.17
	Med Cert 03	*** 2.43	*** 2.40
	Med Cert 04	*** 2.50	*** 2.51
	Med Cert 05	*** 2.62	*** 2.55
	Med Cert 06+	*** 2.66	*** 2.74
	Med Cert None	0	
Interval from spell start weeks	Period 01	*** -0.93	*** -0.99
	Period 02	0.07	-0.42
	Period 03	** 0.46	0.39
	Period 04	** 0.53	** 0.45
	Period 05	0.36	0.35
	Period 06	*** 0.72	** 0.62
	Period 07	*** 0.74	** 0.57
	Period 08	*** 0.87	** 0.40
	Period 09	*** 0.85	0.34
	Period 10	*** 0.89	*** 0.67
	Period 11	*** 0.97	*** 0.73
	Period 12	*** 0.97	*** 0.86
	Period 13	*** 1.02	*** 0.82
	Period 14	*** 0.98	*** 0.92
	Period 15	*** 1.00	*** 0.90
	Period 16	*** 0.92	*** 0.91
	Period 17	*** 0.77	*** 0.85
	Period 18	** 0.62	*** 0.68
	Period 19	*** 0.71	*** 0.78
	Period 20	*** 0.73	*** 0.73
	Period 21	*** 0.63	** 0.61
	Period 22	*** 0.86	0.40
	Period 23	*** 0.66	** 0.49
	Period 24	** 0.58	** 0.53
	Period 25	*** 0.74	** 0.58

*: p value <0.1, **: p value <0.05, ***: p value <0.001.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Estimated impact on hazard of exiting current sickness benefit spell

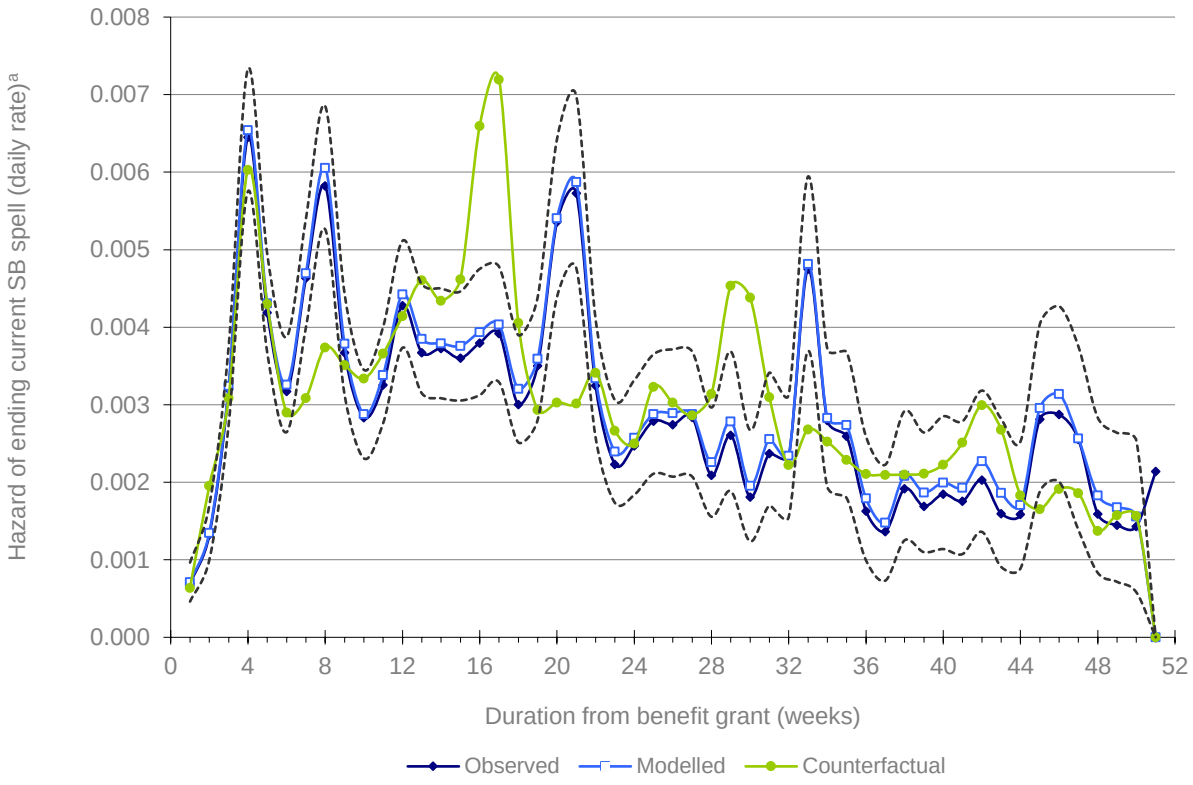
Based on the duration model results in Table 3, Figure 5 shows the estimated impact of the introduction of the eight-week medical certificate on exiting SB. Figure 5 shows the hazard rate of ending SB spell. For each interval, we show the estimated hazard of ending current SB spell based on two scenarios.

The first is that they went through the post May 2011 medical certificate process and reflects the observed outcomes (called the modelled hazard). By comparing the modelled and observed hazard rate, we can get a sense of how well we could represent the actual pattern of exits from SB. Overall, the modelled hazard rate represents the observed pattern to a reasonable level. However, the observed peaks at the second (week 8) and third (week 21) are slightly lower than the modelled hazard midpoint.

The second scenario is the counterfactual, and represents what we would expect to have happened if the medical certificate process had not been changed in May 2011. The counterfactual was estimated in two steps:

- Simulate when each client would have had a medical certificate expiry if they had been granted SB before May 2011. Simulated expiry dates were based on the historical pattern of medical certificate expiries (see page 57 for how this was done).
- Estimate the hazard of ending current SB spell based on the hazard model using the pre May 2011 medical certificate and duration interval parameters (see Table 3). All other client characteristics and model parameters remained the same.

Figure 5: Modelled impact of the May 2011 change to medical certificate process on the hazard rate of ending SB spell



a: Based on model parameter values and observed characteristics of those clients subject to the post May 2011 medical certificate process (modelled and counterfactual) and actual exit events (observed).
Modelled: Based on characteristics of clients who participated in the May 2011 medical certificate process using model estimates.
Counterfactual: The counterfactual was estimated by simulating medical certificate expiries for clients as if they had commenced their benefit spell before May 2011.
The dotted lines indicate the 95 percent confidence interval for the modelled line.

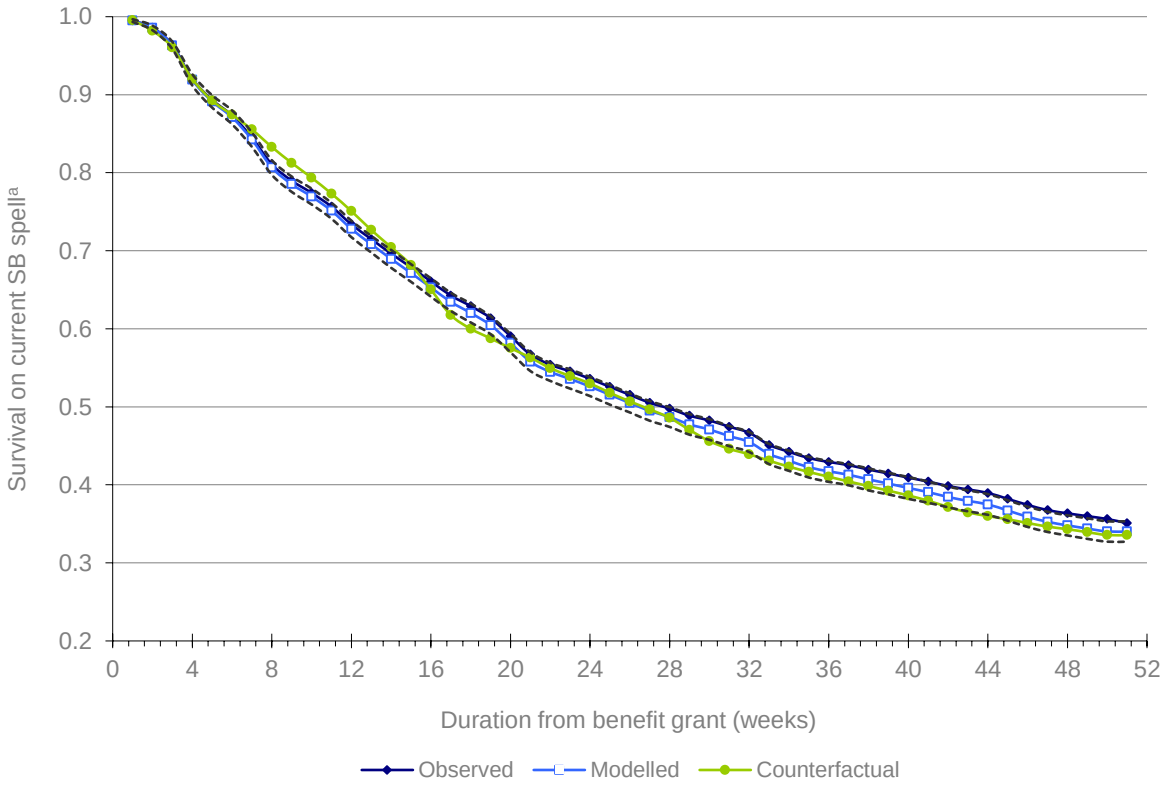
Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Impact of eight-week medical certificate on remaining on sickness benefit

From a policy and operational perspective, hazard rates are not particularly meaningful. Therefore, the next step is to convert these into more easily interpreted values. Figure 6 converts the hazard rates in Figure 5 to survival curves. The observed curve represents the actual survival of clients granted SB after May 2011, while the model curve is the estimate from our duration model.

Comparing the counterfactual and model curves, we can see the estimated impact of the reapplication process on the duration on SB. The largest impact is between eight and 15 weeks, with the eight-week medical certificate reducing the proportion on SB. However, by week 17 the modelled and counterfactual have converged. Note that week 17 is when most clients would have had their second medical certificate before May 2011 (see Figure 2). The second effect is that between week 17 and 21 the counterfactual survival is slightly lower than the model survival curve. We attribute this to the shift in the timing of medical certificate from 17 weeks, before May 2011, to 21 weeks, after May 2011.

Figure 6: Modelled impact of the May 2011 medical certificate process on survival on current SB spell



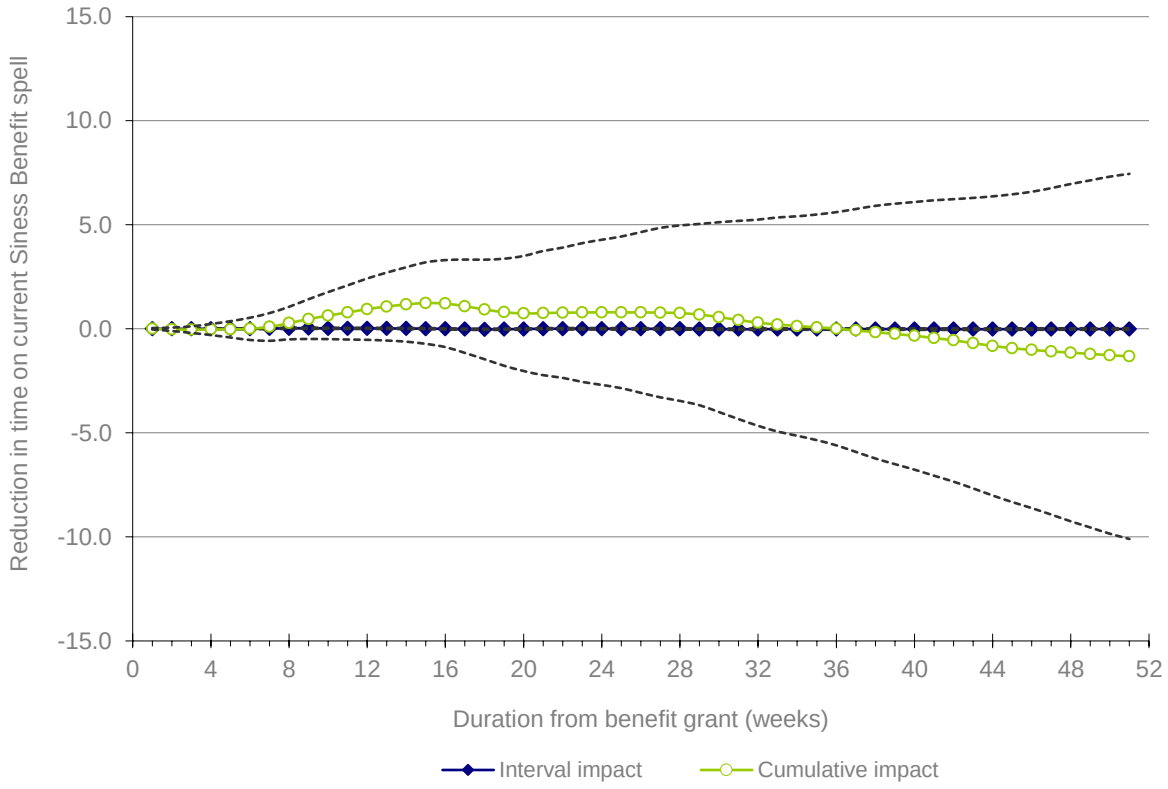
a: Based on model parameter values and observed characteristics of those clients subject to the post May 2011 medical certificate process (modelled and counterfactual) and actual exit events (observed).
Modelled: Based on characteristics of clients who participated in the May 2011 medical certificate process using model estimates.
Counterfactual: The counterfactual was estimated by simulating medical certificate expiries for clients as if they had commenced their benefit spell before May 2011.
The dotted lines indicate the 95 percent confidence interval for the modelled line.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Impact of reapplication process on time spent on current sickness benefit spell

Based on the survival curves in Figure 6 we can represent the impact of the reapplication process as a reduction in the average time clients spent on their SB spell. Figure 7 shows the reduction in time clients spend on SB in each interval (interval impact) and the total time over the entire period (cumulative impact). The first observation is that the interval impact is very small, with the largest impact at week 9 of 0.03 (± 0.027) fewer days on SB. The impact of the eight-week medical certificate can clearly be seen in the cumulative impact. After the eight-week point we see a reduction in the average time clients spend on SB reaching a peak of 1.24 (± 1.96) days of benefit at 15 weeks after starting the SB. However, after this point the cumulative impact steadily decreases to become -1.33 (± 8.77) days at 51 weeks. As Figure 7 makes clear, at no time is the cumulative impact statistically significant.

Figure 7: Interval and cumulative impact of the Future Focus changes to SB medical certificates on time spent on current SB spell



The dotted lines indicate the 95 percent confidence interval for the impact of the reapplication process compared to the counterfactual.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Number of medical certificate expiries

Alongside any change in the overall duration on SB, we can also examine the impact on the average number of medical certificates clients complete while on SB. Any impact on the number of medical certificates clients complete will have a bearing on the overall cost of the policy change on:

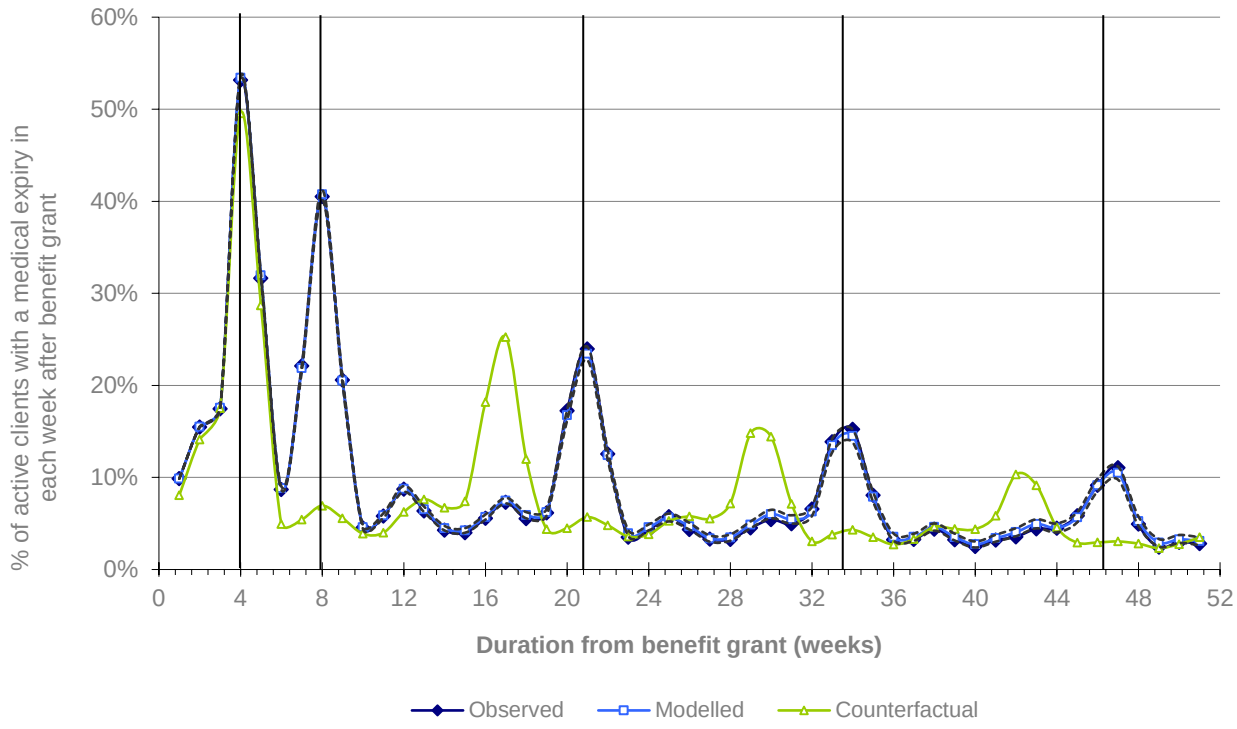
- clients, in the time and cost of obtaining a medical certificate from their doctor
- the health system, through increased administration of medical certificates by doctors
- Work and Income, in the processing of medical certificates.

Change in the distribution of medical certificates

Figure 8 shows the observed, modelled and counterfactual distribution of medical certificate events for SB clients. The observed and modelled distributions match quite closely and show the peaks in medical certificate expiry under the post May 2011 changes (indicated by the vertical lines in Figure 8).

To calculate the impact of the change in medical certificate expiry frequency, we convert the results in Figure 8 to a cumulative count from SB grant (Figure 9). What Figure 9 shows is the average number of medical certificates clients complete at each week after grant. At five weeks after grant, clients will have had at least one medical certificate expiry. Over the full follow-up period (51 weeks), we expect every client granted an SB to complete an average of 3.3 medical certificates. This number is based on the frequency with which clients are required to complete medical certificates and the time that clients spend on SB after grant.

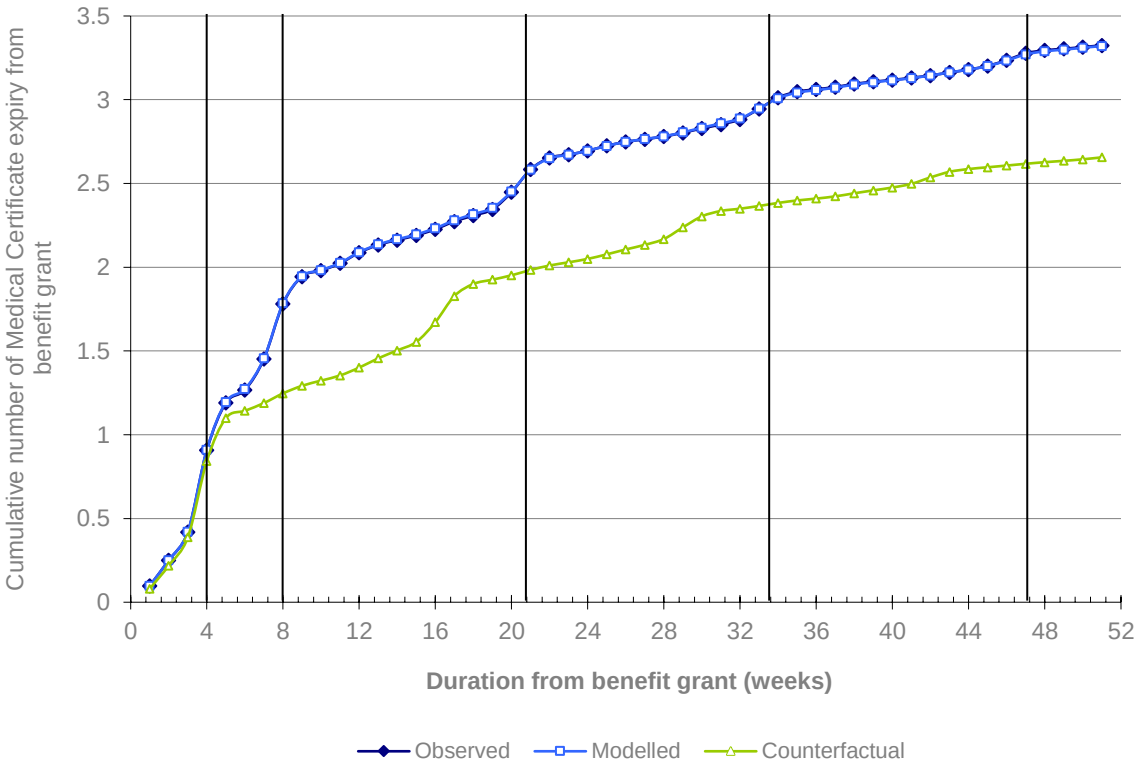
Figure 8: Clients on SB with a medical certificate at each period after grant



Modelled and counterfactual based on expected distribution of medical certificate end dates and simulated duration on SB. The dotted lines indicate the 95 percent confidence interval for the modelled line.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Figure 9: Average number of medical certificate expiries completed each week after SB grant



Modelled and counterfactual based on expected distribution of medical certificate end dates and simulated duration on SB.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

By comparing the modelled and counterfactual lines in Figure 9, it is evident that clients, on average, have to complete more medical certificates after May 2011. At 51 weeks, the observed average number of medical certificates completed is 3.3, while the model estimate is 3.3 (± 0.3). This number compares to the counterfactual estimate of 2.7 medical certificates, a difference of 0.7 (± 0.1) medical certificates completed for each SB grant. Therefore, the introduction of the eight-week medical certificate since May 2011 has increased the overall cost of income support administration. This increase has occurred because the introduction of the additional medical certificate expiry at eight weeks has not significantly altered the time clients remain on SB.

Duration on any main benefit

Having established that the eight-week medical certificate has not altered the time clients spend on benefit, it is not surprising there is also no change in continuous duration on benefit.

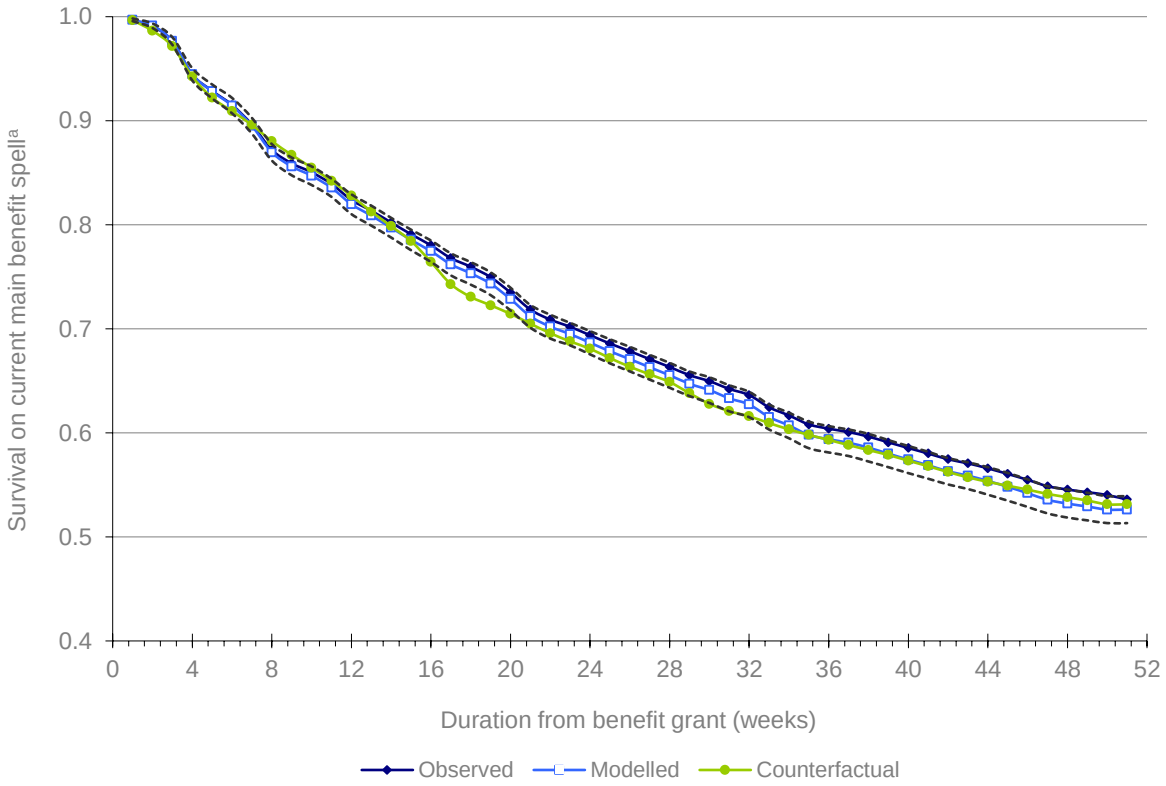
Duration on any main benefit

In this analysis, we combine any consecutive spell on any main benefit (ie Unemployment, Sickness, Invalid's (IB), Domestic Purposes (DPB) and retirement related) into a single spell. Spells separated by more than one day are defined as a new benefit spell. Any change in partner status has no effect on spell duration, so a client changing from single to a partner will not end their current spell on main benefit. The data is based on the most current version of the administrative data and therefore spells include retrospective changes to spell history.

Impact of the change in medical certificate frequency on the duration of main benefit spell

Figure 10 shows the survival on any main benefit and is for the same sample of clients as shown in Figure 6. Comparing the observed and modelled curves, we can assess how well the duration modelling is able to reflect the survival of clients on main benefit. The difference between the model and counterfactual proportion on main benefit is the estimated impact of the reapplication process. What is quite evident is that the change in medical certificate frequency has had no substantial or significant impact on clients' remaining on main benefit. At 51 weeks, we estimate that clients spent 1.6 (± 8.87) more days on main benefit as a result of the policy change.

Figure 10: Modelled impact of the change in medical certificate frequency on duration on any main benefit spell



a: Based on model parameter values and observed characteristics of those clients subject to the post May 2011 medical certificate process (modelled and counterfactual) and actual exit events (observed).
Modelled: Based on characteristics of clients who participated in the May 2011 medical certificate process using model estimates.
Counterfactual: The counterfactual was estimated by simulating medical certificate expiries for clients as if they had commenced their benefit spell before May 2011.
The dotted lines indicate the 95 percent confidence interval for the modelled line.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Duration off main benefit

The last outcome we examine is how soon clients return after exiting their current spell on main benefit.

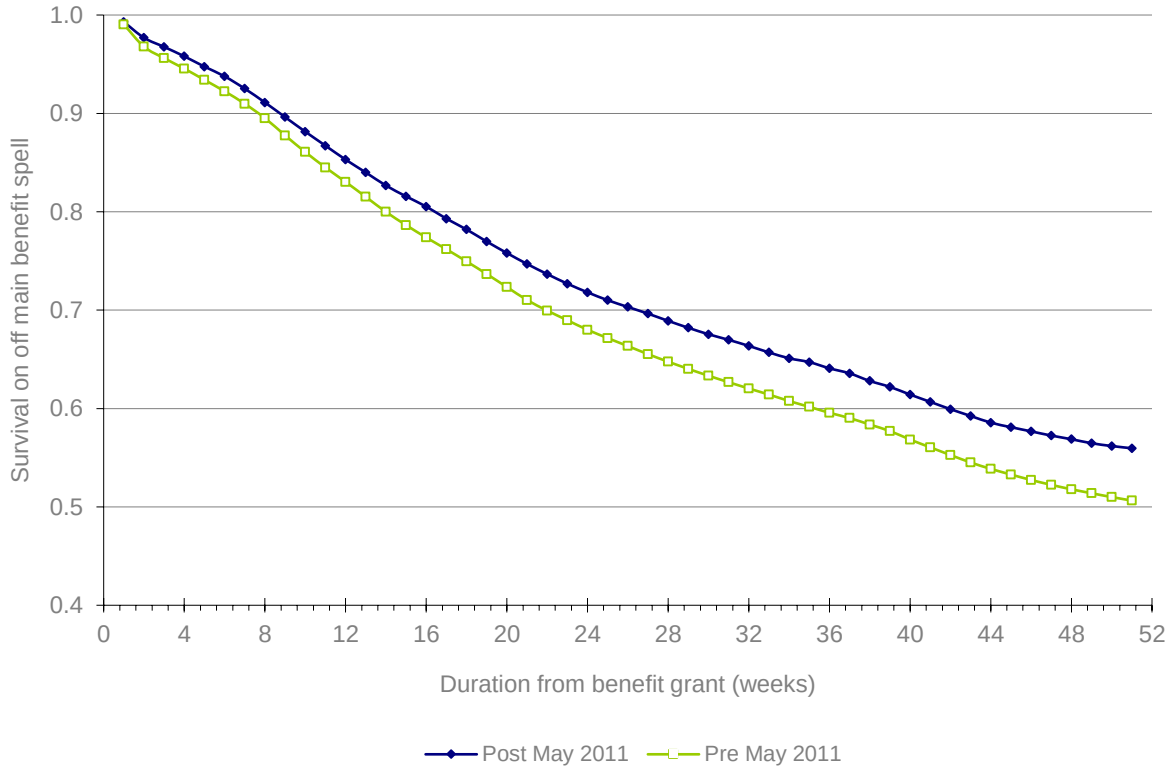
Definition of off-benefit spell

Off-benefit spells are defined as starting when a client exits main benefit for more than one day. The spell ends when they return to a main benefit.

Observed survival off main benefit

Figure 11 shows the survival off main benefit for clients commencing SB before and after May 2011. What is quite apparent is the difference in survival, with those exiting after May 2011 remaining off main benefit for longer than those who had exited before May 2011. The question is whether the change in medical certificate frequency had any impact.

Figure 11: Survival of remaining off main benefit for clients granted SB



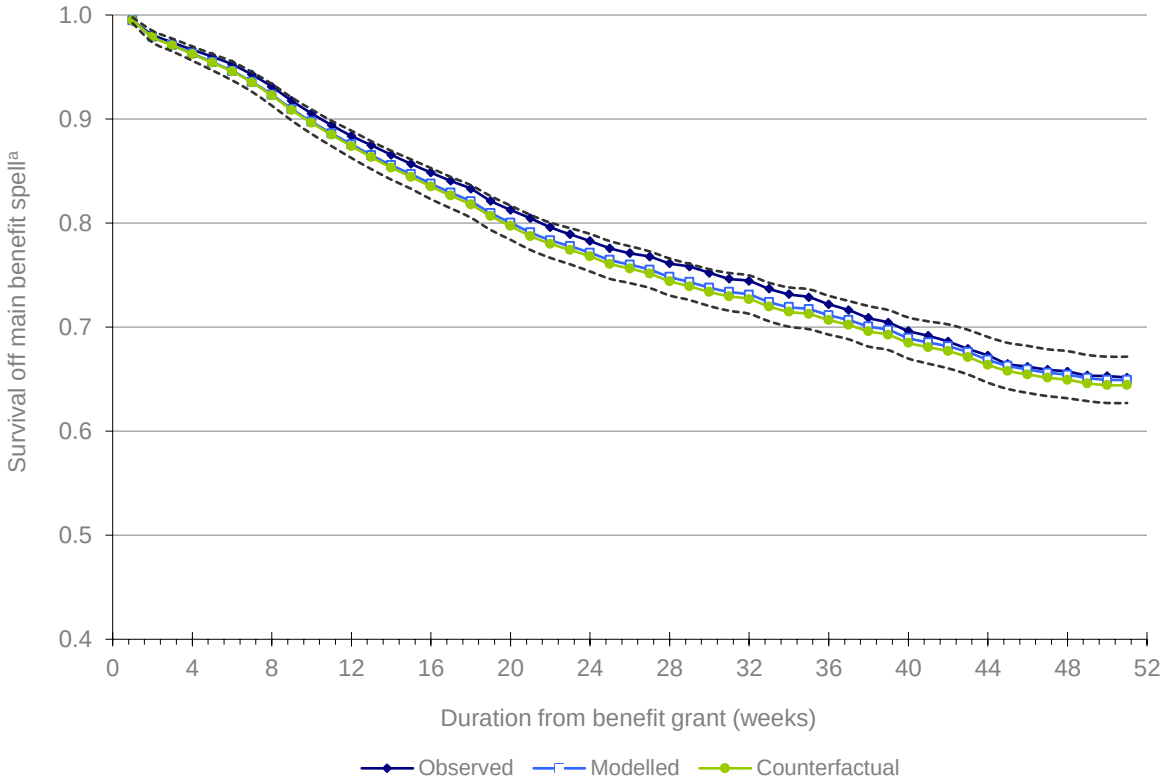
a: Proportion who remain continuously off any main benefit.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Frequency of medical certificate impact on duration off main benefit

Figure 12 shows the duration off main benefit between observed, modelled and counterfactual scenarios. Although the survival off benefit after May 2011 is higher than previously, we can see no compelling reason that this was because of the change in medical certificate process. We attribute this difference to the change in economic conditions, particularly the downturn in labour market demand between 2008 and 2010. From these results, we can conclude that the change to medical certificate had no impact on the time clients remained off main benefit.

Figure 12: Modelled impact on duration off main benefit



a: Based on model parameter values and observed characteristics of those clients subject to the post May 2011 medical certificate process (modelled and counterfactual) and actual exit events (observed).
Modelled: Based on characteristics of clients who participated in the May 2011 medical certificate process using model estimates.
Counterfactual: The counterfactual was estimated by simulating medical certificate expiries for clients as if they had commenced their benefit spell before May 2011.
The dotted lines indicate the 95 percent confidence interval.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Total time on main benefit

We can combine the on main benefit and off main benefit model to arrive at an estimate of the reduction in overall time on benefit (see technical notes for more detail on how this was done).

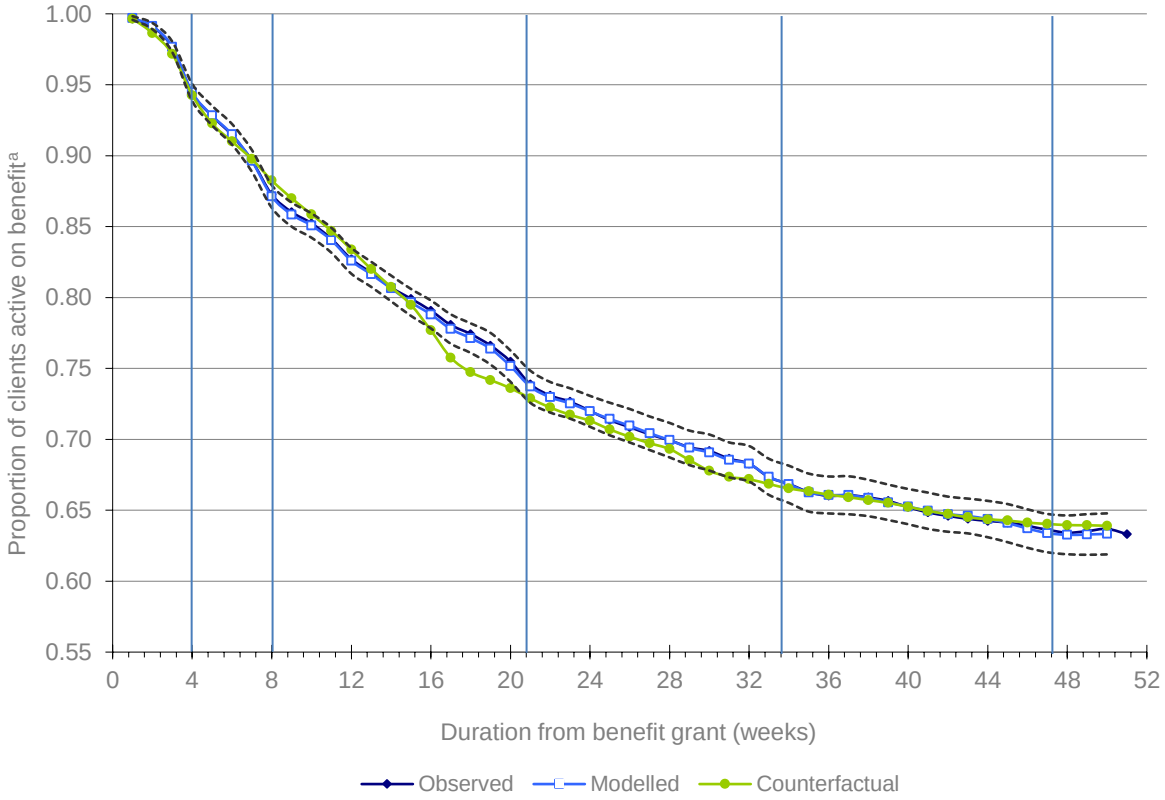
Proportion of clients on main benefit

Figure 13 shows the probability clients will be on benefit after SB grant. Unlike previous analysis, these are not survival curves. Instead, the figures show the probability of being on benefit (ie they include both the time to benefit exit and the time to return to benefit). This means we can account for any effects of policy changes on off benefit as well as on benefit. If a client returns to benefit, they remain on benefit for the remainder of the outcome period.[4]

The modelled proportion on benefit matches the observed proportion (Figure 13). Consistent with the individual models, we see little difference in the proportion of clients on benefit between the modelled and counterfactual.

[4] This assumes the introduction of the eight-week medical certificate had no impact on duration of subsequent benefit spells.

Figure 13: Observed, modelled and counterfactual estimates of the proportion of clients on main benefit



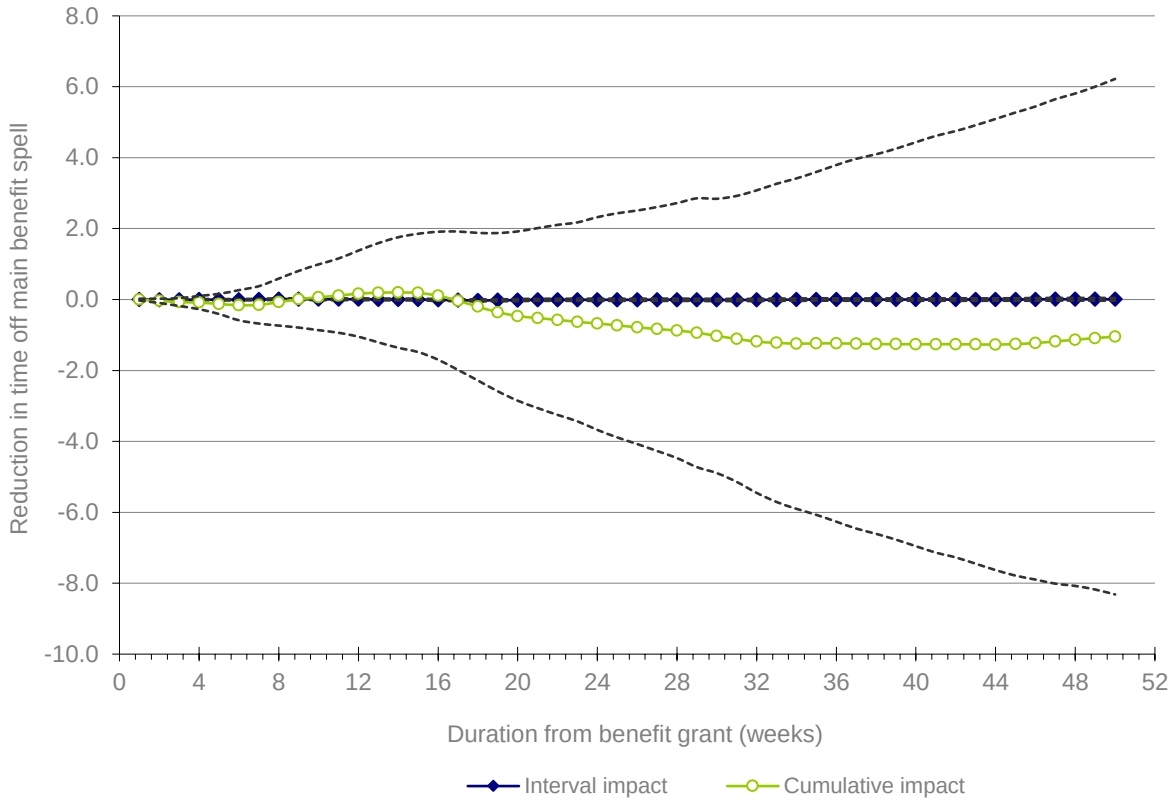
a: Based on model parameter values and observed characteristics of those clients subject to the post May 2011 medical certificate process (modelled and counterfactual) and actual exit events (observed).
Modelled: Based on characteristics of clients who participated in the May 2011 medical certificate process using model estimates.
Counterfactual: The counterfactual was estimated by simulating medical certificate expiries for clients as if they had commenced their benefit spell before May 2011.
The dotted lines indicate the 95 percent confidence interval.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Duration on main benefit

Looking at the difference between counterfactual and model probabilities, Figure 14 shows the interval and cumulative impact of the change in medical certificate process on the time on main benefit. At 50 weeks after grant, we estimate affected clients spent 1.0 (± 7.27) more days on main benefit than if they had not been required to complete a medical certificate at eight weeks. Since the confidence interval is 7.27 days, we can say that the change made no material difference to the overall time on main benefit.

Figure 14: Interval and cumulative impact of the reapplication process on time spent on any benefit



The dotted lines indicate the 95 percent confidence interval.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Summary of impacts

Table 4 summarises the cumulative impact for each of the outcomes covered in this analysis for selected lapse periods. For example, participating clients spent an average of 207 days on SB in the first 50 weeks after grant.

Overall the eight-week medical certificate made no difference to time on benefit

The introduction of the eight-week medical certificate did not reduce the time clients are on main benefit in the first year after SB grant.

The change in medical certificate process has increased benefit administration costs

Because the introduction of the eight-week medical certificate did not alter the overall time clients spent on SB, the policy change has increased the average number of medical certificates clients need to complete.

With the eight-week medical certificate process, clients complete an average of 3.3 medical certificates over the first 52 weeks after SB grant.[5] We estimate that without the eight-week medical certificate, clients would have completed 2.7 (±0.3) medical certificates on average. Therefore, the introduction of the eight-week medical certificate has increased the average number of medical certificates completed by 0.7 (±0.1).

[5] This excludes any medical certificate completed if they exit and return to SB over this period.

Table 4: Summary of cumulative outcomes and impacts of the eight week medical certificate process

Outcome	Estimate (days)	Lapse period (weeks from SB grant) 10	26	39	50
Duration on SB-related benefit	Observed	69	138	179	207
	Modelled	69 (±0.9)	137 (±3.0)	177 (±4.9)	205 (±6.6)
	Counterfactual	69	138	177	204
	Impact	-0.6 (±1.1)	-0.8 (±3.9)	0.2 (±6.3)	1.3 (±8.6)
Continuous duration on benefit	Observed	72	156	212	255
	Modelled	72 (±0.7)	155 (±2.7)	211 (±4.6)	253 (±6.1)
	Counterfactual	72	154	209	251
	Impact	-0.1 (±0.9)	0.8 (±3.6)	1.5 (±6.1)	1.6 (±8.6)
		Lapse period (weeks from benefit exit) 10	26	39	50
Off benefit after benefit exit	Observed	74	166	233	285
	Modelled	73 (±1.0)	165 (±4.0)	232 (±6.8)	284 (±9.9)
	Counterfactual	73	165	231	283
	Impact	0.0 (±1.1)	0.3 (±4.5)	0.6 (±8.9)	0.9 (±13.4)
		Lapse period (weeks from SB grant) 10	26	39	50
On any main benefit	Observed	65	151	212	262
	Modelled	65 (±0.7)	151 (±2.5)	212 (±4.1)	261 (±5.5)
	Counterfactual	65	150	211	260
	Impact	-0.1 (±0.9)	0.8 (±3.3)	1.3 (±5.5)	1.0 (±7.3)

Observed: Actual duration of clients who have participated in the reapplication process.
Modelled: Estimated duration of participating clients based on regression duration models.
Counterfactual: Estimated duration if clients had not participated in the reapplication process.
Impact: Difference between the modelled and counterfactual duration on benefit.
Bracketed figures provide 95 percent confidence interval for the estimate.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Technical notes

Overall approach

Duration (or survival) analysis is a method of analysing the time taken for an event of interest to occur (ie exit from a benefit). Duration analysis helps us understand how the variation across individuals in the time taken to an event is related to possible explanatory factors (eg characteristics of the individual). This study extends the approach taken by Dalgety, Dorsett, Johnston, & Spier (2010) in evaluating the impact of Working for Families on sole parents in receipt of DPB–Sole Parent. Specifically we examine whether change in the frequency of medical certificate expiry dates changes how soon clients:

- exit from SB
- exit from any main benefit
- return after they exit benefit.

Based on these models we also determine:

- reduction in the time on benefit.

Key assumptions

All impact methods are based on a number of assumptions. The important ones to be aware of are outlined below.

Omitted variable bias

A key assumption in our approach is that we have accounted for all variables that should be in the model. Of course, we cannot be sure of this. The danger is that we have missed important variables correlated with variables already included in the model. The effect of such an omitted variable is to bias the estimates of the parameters for the variables in the model (ie our parameter estimates for the model variables do not reflect their true influence on benefit outcomes). The greatest concern will be for the medical certificate expiry variable in the model. If there is an omitted variable that influences benefit outcomes and is correlated with the change in medical certificate expiry dates, this will bias our estimates of its impact. In other words, we will mistakenly attribute the change in duration because of the omitted variable to the change in medical certificate expiry dates.

We have undertaken an environmental scan and conclude that there were no other changes occurring in tandem with the change in medical certificate expiry dates that could account for the impacts observed. We have also taken care to reduce the risk of omitted variable bias more generally by including variables in the model to try to control for all theorised influences on benefit duration.

No selection bias

Duration modelling is usually applied to policies and programmes for which clients have little or no control over their participation. In other words, people cannot easily select themselves out of the programme or policy. If selection occurs, it may mean that our estimates of programme and policy impacts reflect these selection effects rather than the policy effects. How selection might occur will depend on the specific situation. In the case of the change in medical certificate expiry dates, we do not expect any selection bias, since those subject to the process cannot opt out of it other than

through transferring to benefits other than sickness. We are examining both these responses through the analysis.

Data sources and variables

The analysis uses several sources of information, primarily data from MSD administrative systems housed on the Ministry's Information Analysis Platform (IAP). We also include Household Labour Force Survey (HLFS) and other labour market information where necessary.

Benefit data (BDD)

The analysis is centred on the Benefit Dynamics Dataset (BDD), a longitudinal dataset assembled from historical benefit administration data. The BDD can be used to create individual benefit histories for each adult or child ever included on a main benefit from 1993 onwards. The BDD has a number of strengths, including:

- a relatively long study period – at the time of writing, the BDD lets us view and analyse 19 years of benefit history at the individual level
- no sampling error, or response or attrition bias – the dataset contains information on all benefit recipients and not a sample, so sampling error, response bias and bias resulting from attrition are not issues for this analysis
- continuous longitudinal data – the continuous nature of the dataset means that we are not limited to monthly or quarterly snapshots of benefit status, which means we are able to observe benefit spells of relatively short duration, making our calculations of total time spent on benefit very precise. Such precision means we can link the timing of events during a benefit spell to the hazard rate.

Participants

In this analysis, the study population is those who commenced SB after May 2011. These clients are subject to the new frequency of medical certificate expiry dates at four, eight and 21 weeks. The experience of these clients is compared to those who commenced SB before May 2011 and were subject to medical certificate expiry at four, 17 and 30 weeks.

Because we include partners, the number of clients starting SB will be larger than what is reported in the monitoring information on benefits in force.

Defining medical certificate expiry dates

When a client is granted an SB, the benefit has an expiry date assigned based on when the client will need to present a medical certificate to continue their benefit entitlement. The duration is system defined, but case managers can modify expiry dates if necessary. Allowing case manager adjustments means medical certificate expiry dates do not all occur at fixed intervals after benefit grant (eg four, eight, 21 weeks etc). Benefit expiry is stored in SWIFTT table SEXPR.

Modelling benefit spells

This section describes the broad approach to modelling the time that clients spend on or off main benefit.

Definition of the hazard function

From the IAP we have exact information on when a client starts and ends a benefit spell. However, for analytical simplicity we converted these continuous time units into discrete intervals of seven days' duration. Therefore, the approach we took to modelling the data is an example of 'discrete-time' survival analysis (Kittle, Richardson, & Parker, 1981).

For each individual *i* interval *t* we have a status y_{it} 0 or 1 for whether the individual ended their spell in the interval.

The hazard function (h_{it}) for an individual at each interval is:

$$h_{it} = \Pr(y_{it} = 1 \mid y_{ik} = 0 \text{, for all } k \in \{1,....,t_{-1}\}) \quad (1)$$

That is the probability an individual will end their spell at interval *t* given their spell has lasted for *t*-1 intervals. Related to the hazard function is the survival function S_{it}, which is the probability the individual *i* was still on benefit at the end of interval *t*.

$$S_{it} = \Pr(y_{ik} = 0 \text{, for all } k \in \{1,....,t\}) \quad (2)$$

The survival function is the product of terms involving the hazard.

In our model, the hazard function is assumed to relate to the explanatory variables through a logit transformation:

$$\log\left(\frac{h_{it}}{1-h_{it}}\right) = \alpha(t) + \beta' X_{it} \quad (3)$$

where $\alpha(t)$ is the baseline hazard and X_{it} is a vector of covariates representing the values for an individual *i* at interval *t*. The variables for X_{it} are summarised below in the section on explanatory variables.

As the previous equation shows, each model has two parts, the baseline hazard and fixed and time-varying individual characteristics. The baseline hazard characterises the overall pattern of exits over spell duration. Individual characteristics on the other hand identify how an individual's probability of ending a spell varies according to their fixed characteristics (eg age or education) as well as those that vary over time (eg labour market demand or policy changes).

Estimation of model parameters

Allison (1982) shows how the parameters of the discrete-time hazard model in equation (3) can be estimated using standard logistic regression procedures, after restructuring the data so there is one record for each time period that each person is at risk of experiencing the event of interest (ie constructing a 'person-period dataset').

Defining benefit spells

In the analysis, we need to define three benefit spells:

- SB
- main benefit
- off benefit.

Based on administrative records of benefit spells, we first concatenate all consecutive SB-related spells. In addition, we treat partners in the same way as primary or single clients on benefit. Therefore, if a client starts as a partner on SB and then becomes a single on SB (technically a new benefit spell), this is also defined as a continuation of the initial spell.

In addition to the continuous spell on SB, we also calculate the continuous time the client remains on any main benefit. Main benefits include: Unemployment, Sickness, Invalid's, Domestic Purposes (including Widow's) and retirement related (eg New Zealand Superannuation (NZS)). Any consecutive main benefit spells are combined into a single spell. Therefore, for each SB spell, the corresponding main benefit spell will be of either equal or longer duration.

The last spell is the spell off main benefit. This occurs only for clients who exit main benefit and lasts until the client returns to main benefit.

Selecting analysis sample

From all concatenated SB spells, we identified all clients who commenced an SB spell from 1 January 2008 to December 2012. Because of the large number of qualifying records, we needed to select a sample for analysis. Our initial sample constituted 40,000 spell starts. Selection was a two-stage process. First, we randomly selected one SB spell for each client. The second stage involved sampling a fixed percentage of spell starts each month to ensure the sample is representative of clients over the analysis period.

All the models are based on the same sample of clients.

Creating a person-period dataset

For each spell, we created a 'person-period' dataset. To do this we divided each spell into evenly spaced intervals of seven days. Each interval can have one of three statuses:

- no exit (the spell did not end within the interval and the interval end date is less than the censor date)
- exit (the spell ended during the interval and the interval end date is less than the censor date)
- censored (the spell end date is greater than the censor date).

Censoring occurs either because the spell is current to the end of the analysis period (December 2012) or the spell duration exceeds 360 days.

Time-varying client characteristics are calculated at the interval start date.

Defining interval duration

The selection of the duration of the interval in the analysis is a trade-off between identifying detailed events and computational resources. We selected a seven-day interval, since medical certificate expiries tend to be defined in weekly intervals. To manage computational resources we limited the outcome window to 360 days.

Final structure of the person-period dataset

Based on the discussion above, the person-period dataset has the following variables:

- SB spell start: the date the client commenced a qualifying SB spell
- SB spell end date: the date the client ended their SB spell, either exiting benefit for one day or transferring to another main benefit
- main benefit end date: the date the main benefit spell ended, if at all
- off-benefit return date: if a client exited from main benefit, the date they returned to main benefit, if at all.

Explanatory variables

Below is a summary of the variables that were included in the analysis. Note that not all these variables were included in the final models.

Labour market variables

Variable	Fixed/Variable	Type	Description
TLA	Varying	Categorical	Territorial local authority based on client's district office
ExitRate	Varying	Continuous	Standardised exit rate by month, TLA and main benefit group
ExitRateSE	Varying	Continuous	Seasonally adjusted standardised exit rate by month, TLA and main benefit group
EntryRate	Varying	Continuous	Standardised entry rate by month, TLA and main benefit group
EntryRateSE	Varying	Continuous	Standardised entry rate by month, TLA and main benefit group
StEntries	Fixed	Continuous	Standardised entry rate by month, TLA and main benefit group when spell commenced
EmpRate	Varying	Continuous	Regional employment rate from HLFS by quarter
UnempRate	Varying	Continuous	Regional unemployment rate from HLFS by quarter
Month	Varying	Categorical	Month the interval falls into
StartMonth	Fixed	Categorical	Month at spell start date

Calculating benefit entry and exit rates

Benefit entry and exit rates are based on MSD official monthly statistics on the number of clients on main benefit and grants and cancellations during the month. For each main benefit group and TLA, we calculate the entry, exit and turnover rates. For example, the exit rate would be the number of benefit grants in the month divided by those on benefit at the end of the previous month. We standardised these rates by TLA and benefit group (ie the exit rate in each month divided by the monthly average for the analysis period).

Table 5: Labour market variables of sampled clients at start of on benefit and off benefit spell

		Continuous duration on benefit		Off benefit after benefit exit	
Variable	Category	Average	SE	Average	SE
EmpRate		0.68	0.00	0.68	0.00
Month	January	0.07	0.00	0.11	0.01
	February	0.05	0.00	0.07	0.01
	March	0.05	0.00	0.06	0.01
	April	0.04	0.00	0.06	0.01
	May	0.10	0.01	0.06	0.01
	June	0.10	0.01	0.07	0.01
	July	0.10	0.01	0.09	0.01
	August	0.10	0.01	0.08	0.01
	September	0.09	0.01	0.09	0.01
	October	0.09	0.01	0.12	0.01
	November	0.10	0.01	0.11	0.01
	December	0.10	0.01	0.09	0.01
Quarter	Quarter 1	0.17	0.01	0.25	0.01
	Quarter 2	0.25	0.01	0.19	0.01
	Quarter 3	0.29	0.01	0.26	0.01
	Quarter 4	0.29	0.01	0.31	0.01
StartMonth	January	0.07	0.00	0.11	0.01
	February	0.05	0.00	0.07	0.01
	March	0.05	0.00	0.06	0.01
	April	0.04	0.00	0.06	0.01
	May	0.10	0.01	0.06	0.01
	June	0.10	0.01	0.07	0.01
	July	0.10	0.01	0.09	0.01
	August	0.10	0.01	0.08	0.01
	September	0.09	0.01	0.09	0.01
	October	0.09	0.01	0.12	0.01
	November	0.10	0.01	0.11	0.01
	December	0.10	0.01	0.09	0.01
UnempRate		0.07	0.00	0.07	0.00

Demographic variables

Variable	Fixed/Variable	Type	Description
Age	Fixed	Continuous	Age at spell start
Age group	Fixed	Categorical	Age group at spell start
Gender	Fixed	Categorical	Gender
Ethnicity	Fixed	Categorical	Ethnicity

Table 6: Demographic profile of sampled clients at start of on benefit and off benefit spell

		Continuous duration on benefit		Off benefit after benefit exit	
Variable	Category	Average	SE	Average	SE
Age		37.48	0.27	35.88	0.41
Agegroup	16-<18 yrs	0.01	0.00	0.01	0.00
	18-<20 yrs	0.10	0.01	0.09	0.01
	20-<25 yrs	0.18	0.01	0.21	0.01
	25-<30 yrs	0.10	0.01	0.12	0.01
	30-<35 yrs	0.08	0.00	0.09	0.01
	35-<40 yrs	0.08	0.00	0.08	0.01
	40-<45 yrs	0.09	0.01	0.09	0.01
	45-<50 yrs	0.09	0.01	0.09	0.01
	50-<55 yrs	0.09	0.01	0.08	0.01
	55-<60 yrs	0.09	0.01	0.07	0.01
	60-<65 yrs	0.08	0.00	0.06	0.01
	65+ yrs	0.01	0.00	0.00	0.00
AgeSqr		1,624.32	21.21	1,482.33	32.22
Ethnicity	NZ European	0.44	0.01	0.49	0.01
	Māori	0.29	0.01	0.25	0.01
	Pacific peoples	0.08	0.00	0.07	0.01
	Other	0.15	0.01	0.15	0.01
	Unspecified	0.04	0.00	0.04	0.01
Gender	Female	0.50	0.01	0.46	0.01
	Male	0.50	0.01	0.54	0.01

Benefit status variables

Variable	Fixed/Variable	Type	Description
StBenDur	Fixed	Continuous	Duration on current benefit at spell start (same as BenDur)
StBenDurC	Fixed	Categorical	Duration on current benefit at spell start (grouped) (same as BenDurC)
StBenConDur	Fixed	Continuous	Continuous duration on benefit (duration is retained when transferring between benefits) (same as BenConDur)
StBenConDurC	Fixed	Categorical	Continuous duration on benefit (duration is retained when transferring between benefits) (grouped) (same as BenConDurC)
CurrentServ	Variable	Categorical	Current benefit
StBenType	Fixed	Categorical	Benefit at spell start (same as CurrentServ)
PreOffBenDur	Fixed	Continuous	Time off benefit prior to current benefit spell
PreOffBenDurC	Fixed	Categorical	Time off benefit prior to current benefit spell
PreBen	Fixed	Categorical	Benefit prior to current spell
PreBenDur	Fixed	Continuous	Duration of previous benefit spell
PreBenDurC	Fixed	Categorical	Duration of previous benefit spell (grouped)
CurrentAport	Variable	Categorical	Partner status (primary, partner or single)
BenDur[main benefit type]	Fixed	Continuous	Total time spent on different benefits (eg DPB, unemployment benefit (UB), Independent Youth Benefit (IYB))
BenDurTotal	Fixed	Continuous	Total time spent on any main benefit
BenDurTotalC	Fixed	Categorical	Total time spent on any main benefit (grouped)
AgeFirstBenefit	Fixed	Continuous	Client's age when starting first recorded benefit spell
AgeFirstBenefitC	Fixed	Categorical	Client's age when starting first recorded benefit spell (grouped)

Table 7: Demographic profile of sampled clients at start of on benefit and off benefit spell

		Continuous duration on benefit		Off benefit after benefit exit	
Variable	Category	Average	SE	Average	SE
AgeFirstBenefit		27.79	0.24	27.03	0.36
AgeFirstBenefitC	20-<25 yrs	0.16	0.01	0.19	0.01
	25-<30 yrs	0.10	0.01	0.10	0.01
	30-<35 yrs	0.08	0.00	0.07	0.01
	35-<40 yrs	0.06	0.00	0.06	0.01
	40-<45 yrs	0.05	0.00	0.05	0.01
	45-<50 yrs	0.04	0.00	0.04	0.01
	50-<55 yrs	0.03	0.00	0.03	0.00
	55-<60 yrs	0.03	0.00	0.03	0.01
	60-<65 yrs	0.03	0.00	0.02	0.00
	15-<16 yrs	0.01	0.00	0.00	0.00
	16-<18 yrs	0.15	0.01	0.13	0.01
	18-<20 yrs	0.26	0.01	0.27	0.01
	65+ yrs	0.01	0.00	0.00	0.00
BenDurDPB		506.34	24.67	333.52	31.00
BenDurIB		116.03	10.16	73.25	13.40
BenDurJSAIYB		24.12	1.78	22.48	2.83
BenDurSB		287.07	12.02	293.65	14.71
BenDurTotal		1,710.03	39.48	1,297.20	50.81
BenDurTotalC	<3 months	0.06	0.00	0.14	0.01
	>3-6 months	0.05	0.00	0.13	0.01
	>6 months-1 year	0.08	0.00	0.17	0.01
	>1-2 years	0.11	0.01	0.15	0.01
	>2-3 years	0.07	0.00	0.08	0.01
	>3-4 years	0.05	0.00	0.06	0.01
	>4-5 years	0.04	0.00	0.04	0.01
	>5-6 years	0.04	0.00	0.03	0.01
	>6-8 years	0.06	0.00	0.06	0.01
	>8-10 years	0.05	0.00	0.04	0.01
	10+ years	0.18	0.01	0.11	0.01
	Unspecified	0.21	0.01	0.00	0.00
BenDurUB		770.55	21.76	573.11	28.22
CurrentServ	DPB related	0.04	0.00	0.01	0.00
	SB related	0.76	0.01	0.87	0.01
	UB related	0.18	0.01	0.11	0.01
	IB	0.02	0.00	0.01	0.00
	JSA IYB	0.00	0.00	0.00	0.00
	NZS VP TRB	0.00	0.00	0.00	0.00
PreBen	DPB related	0.09	0.01	0.07	0.01
	SB related	0.22	0.01	0.28	0.01
	UB related	0.42	0.01	0.39	0.01
	IB	0.03	0.00	0.03	0.00
	JSA IYB	0.01	0.00	0.01	0.00
	No benefit	0.24	0.01	0.22	0.01
PreBenDur		330.38	12.00	220.47	14.89
PreBenDurC	<3 months	0.25	0.01	0.34	0.01
	>3-6 months	0.15	0.01	0.17	0.01
	>6 months-1 year	0.14	0.01	0.14	0.01
	>1-2 years	0.10	0.01	0.07	0.01
	>2-3 years	0.04	0.00	0.02	0.00
	>3-4 years	0.02	0.00	0.01	0.00
	>4-5 years	0.02	0.00	0.01	0.00
	>5-6 years	0.01	0.00	0.01	0.00

		Continuous duration on benefit		Off benefit after benefit exit	
Variable	Category	Average	SE	Average	SE
	>6-8 years	0.01	0.00	0.01	0.00
	>8-10 years	0.01	0.00	0.00	0.00
	10+ years	0.01	0.00	0.01	0.00
	Unspecified	0.24	0.01	0.22	0.01
PreOffBenDur		1,977.58	41.45	1,875.61	67.99
PreOffBenDurC	<3 months	0.13	0.01	0.14	0.01
	>3-6 months	0.10	0.01	0.12	0.01
	>6 months-1 year	0.12	0.01	0.15	0.01
	>1-2 years	0.10	0.01	0.11	0.01
	>2-3 years	0.06	0.00	0.05	0.01
	>3-4 years	0.07	0.00	0.04	0.01
	>4-5 years	0.05	0.00	0.04	0.01
	>5-6 years	0.04	0.00	0.04	0.01
	>6-8 years	0.06	0.00	0.06	0.01
	>8-10 years	0.05	0.00	0.05	0.01
	10+ years	0.21	0.01	0.20	0.01
	Unspecified	0.00	0.00	0.00	0.00
StBenConDur		320.75	19.59	219.41	16.21
StBenConDurC	<3 months	0.78	0.01	0.42	0.01
	>3-6 months	0.03	0.00	0.27	0.01
	>6 months-1 year	0.04	0.00	0.23	0.01
	>1-2 years	0.04	0.00	0.03	0.01
	>2-3 years	0.03	0.00	0.02	0.00
	>3-4 years	0.02	0.00	0.01	0.00
	>4-5 years	0.01	0.00	0.01	0.00
	>5-6 years	0.01	0.00	0.00	0.00
	>6-8 years	0.01	0.00	0.00	0.00
	>8-10 years	0.01	0.00	0.00	0.00
	10+ years	0.03	0.00	0.01	0.00
StBenDur		0.00	0.00	105.49	2.40
StBenDurC	< 3 months	0.00	0.00	0.53	0.01
	>3-6 months	0.00	0.00	0.29	0.01
	>6 months-1 year	0.00	0.00	0.18	0.01
	Unspecified	1.00	0.00	0.00	0.00
StEntries		1.04	0.00	1.02	0.01
CurrentAport	Primary	0.01	0.00	0.01	0.00
	Single	0.86	0.01	0.84	0.01
	Spouse	0.12	0.01	0.14	0.01
StBnCD		0.00	0.00	0.00	0.00
StBnCDC	Unspecified	0.00	0.00	1.00	0.00

Migrant status

Variable	Fixed/Variable	Type	Description
Refugee	Fixed	Binary	Identified as a refugee
TimeInNZ	Fixed	Categorical	Time since immigrating (or born in NZ)
Migrant	Fixed	Binary	Recorded as being a migrant to New Zealand
CurrentMigrant	Fixed	Binary	Current migrant for income support eligibility (less than two years in NZ)
EnglishPrefered	Fixed	Binary	English is the migrant's preferred language

Table 8: Migrant profile of sampled clients at start of on benefit and off benefit spell

		Continuous duration on benefit		Off benefit after benefit exit	
Variable	Category	Average	SE	Average	SE
CurrentMigrant	Yes	0.01	0.00	0.00	0.00
EnglishPrefered	Yes	0.98	0.00	0.99	0.00
Migrant	Yes	0.21	0.01	0.21	0.01
Refugee	Yes	0.01	0.00	0.01	0.00
TimeInNZ	<1 yr	0.00	0.00	0.00	0.00
	1-2 yrs	0.00	0.00	0.00	0.00
	2-4 yrs	0.02	0.00	0.02	0.00
	4-8 yrs	0.03	0.00	0.04	0.01
	8-12 yrs	0.04	0.00	0.04	0.01
	12+ yrs	0.11	0.01	0.11	0.01
	New Zealand	0.79	0.01	0.79	0.01

Family characteristics

Variable	Fixed/Variable	Type	Description
ChildAge	Variable	Categorical	Age of youngest child (0-4.5-13.14-18, no child)
StChildAge	Fixed	Categorical	Age of youngest child at spell start (same as ChildAge)
NumChild	Variable	Categorical	Number of children
StNumChild	Fixed	Categorical	Number of children at spell start (same as NumChild)
Partner	Variable	Binary	Whether client has a partner
StPartner	Fixed	Binary	Whether the client has a partner at spell start (same as Partner)

Table 9: Family characteristics of sampled clients at start of on benefit and off benefit spell

		Continuous duration on benefit		Off benefit after benefit exit	
Variable	Category	Average	SE	Average	SE
ChildAge	<5 years	0.07	0.00	0.11	0.01
	5-<14 years	0.05	0.00	0.06	0.01
	14+ years	0.03	0.00	0.02	0.00
	No child	0.85	0.01	0.81	0.01
NumChild	1 child	0.07	0.00	0.09	0.01
	2 children	0.04	0.00	0.05	0.01
	3+ children	0.04	0.00	0.05	0.01
	No child	0.85	0.01	0.81	0.01
Partner	Yes	0.14	0.01	0.16	0.01

Education

Variable	Fixed/Variable	Type	Description
EducationLevel	Fixed	Categorical	Highest recorded education qualification
TertiaryStudy	Variable	Binary	Receiving student loans or allowances
TimeLastSALC	Fixed	Categorical	Time since last recorded student loans and allowances spell at spell start (grouped)
SALtimeC	Fixed	Categorical	Total amount of time receiving student loans or allowances (grouped)
SALtime	Fixed	Continuous	Total amount of time receiving student loans or allowances

Table 10: Education characteristics of sampled clients at start of on benefit and off benefit spell

		Continuous duration on benefit		Off benefit after benefit exit	
Variable	Category	Average	SE	Average	SE
EducationLevel	A: No qualifications	0.32	0.01	0.28	0.01
	B: NQF 1: <80 credit	0.12	0.01	0.12	0.01
	C: NQF 1: 80+ credit	0.07	0.00	0.07	0.01
	D: NQF 2: 80+ credit	0.05	0.00	0.05	0.01
	E: NQF 3: 80+ credit	0.07	0.00	0.06	0.01
	F: NQF 4: 72+ credit	0.04	0.00	0.04	0.01
	G: Degree profession	0.03	0.00	0.04	0.01
	H: Unspecified	0.30	0.01	0.34	0.01
SALtime		198.76	6.97	218.94	12.12
SALtimeC	<3 months	0.02	0.00	0.02	0.00
	>3-6 months	0.05	0.00	0.05	0.01
	>6 months-1 year	0.11	0.01	0.11	0.01
	>1-2 years	0.09	0.01	0.09	0.01
	>2-3 years	0.05	0.00	0.05	0.01
	>3-4 years	0.02	0.00	0.03	0.00
	>4-5 years	0.01	0.00	0.01	0.00
	>5-6 years	0.00	0.00	0.01	0.00
	Unspecified	0.64	0.01	0.62	0.01
	6+ years	0.00	0.00	0.01	0.00
TertiaryStudy	Yes	0.07	0.00	0.07	0.01
TimeLastSALC	<3 months	0.03	0.00	0.03	0.00
	>3-6 months	0.02	0.00	0.02	0.00
	>6 months-1 year	0.03	0.00	0.04	0.01
	>1-2 years	0.05	0.00	0.05	0.01
	>2-3 years	0.03	0.00	0.03	0.01
	>3-4 years	0.02	0.00	0.03	0.00
	>4-5 years	0.02	0.00	0.02	0.00
	>5-6 years	0.02	0.00	0.02	0.00
	>6-8 years	0.03	0.00	0.03	0.00
	>8-10 years	0.03	0.00	0.03	0.01
	10+ years	0.02	0.00	0.03	0.00
	Unspecified	0.70	0.01	0.67	0.01

Ex-prisoner

Variable	Fixed/Variable	Type	Description
ExPrisoner	Fixed	Binary	Whether client has a recorded prison event
TimePrison	Fixed	Categorical	Time since last recorded prison event (grouped)

Table 11: Prison characteristics of sampled clients at start of on benefit and off benefit spell

		Continuous duration on benefit		Off benefit after benefit exit	
Variable	Category	Average	SE	Average	SE
ExPrisoner	Yes	0.09	0.01	0.09	0.01
TimeSincePrison	Never	0.91	0.01	0.91	0.01
	<3 months	0.03	0.00	0.03	0.00
	>3-6 months	0.00	0.00	0.01	0.00
	>6-12 months	0.01	0.00	0.01	0.00
	>1-2 years	0.01	0.00	0.01	0.00
	>2-4 years	0.01	0.00	0.01	0.00
	>4-6 years	0.01	0.00	0.01	0.00
	>6-8 years	0.01	0.00	0.00	0.00
	>8-10 years	0.00	0.00	0.01	0.00
	10+ years	0.02	0.00	0.01	0.00

Part-time work while on benefit

Variable	Fixed/Variable	Type	Description
TotalEarnings	Variable	Continuous	Total declared earnings from work
StTotalEarnings	Fixed	Continuous	Total declared earnings from work at the start of the spell (St)
WorkingPT	Variable	Binary	Whether the client has any declared earnings from work
StWorkingPT	Fixed	Binary	Whether the client has any declared earnings from work at spell start

Table 12: Part time work of sampled clients at start of on benefit and off benefit spell

		Continuous duration on benefit		Off benefit after benefit exit	
Variable	Category	Average	SE	Average	SE
TotalEarnings		13.43	1.17	28.83	2.89
WorkingPT	Yes	0.06	0.00	0.11	0.01

Duration on sickness benefit

The following section examines our analysis of the duration of SB spells and the impact of the reapplication process.

Defining the baseline hazard

The first outcome we examine is the time that people remain on SB. Figure 15 shows the observed and the model's predicted hazard rate. Because the hazard rate is neither constant nor has a linear trend, we used a piecewise constant hazard.

Model fitting

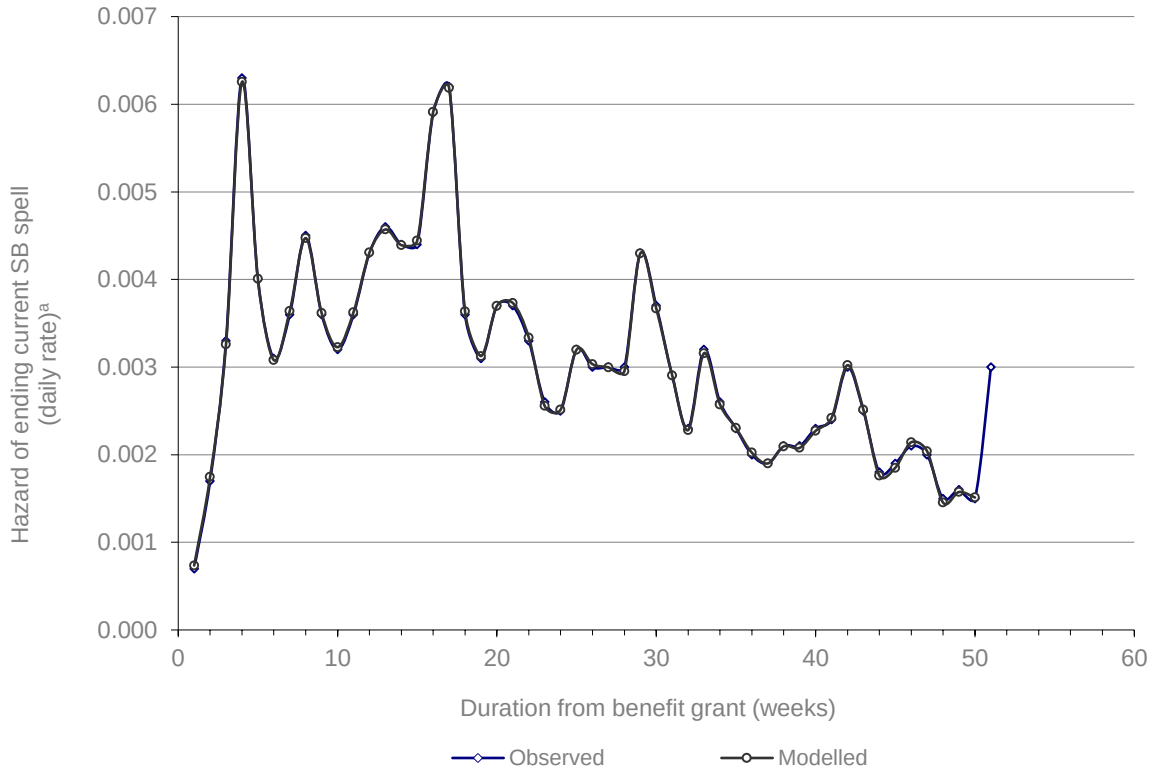
For each group of explanatory variables (eg migrant status, demographic, labour market) we tested each individual variable in a model that included the baseline hazard variable (defined above). From each group, we retained only those variables that showed a significant relationship (type 3, p value <0.05) with the hazard of exiting benefit. For all the significant variables, we ran a full model with all selected variables, then we excluded any that became insignificant (type 3, p value <0.05) at this stage.

With the full model we checked for high levels of multi-collinearity between the explanatory variables. Where variables showed collinearity, we either removed the variable entirely or tested alternatives. A common example was replacing age group with age and age squared.

Final model fit

Figure 15 shows the actual and estimated hazard rate for the full model.

Figure 15: Actual and estimated hazard rate for duration on SB



What influences time on SB?

The full model for the duration on SB contained 20 variables. The type 3 effects are summarised in Table 13 below. Type 3 effect shows the change in the model's overall fit if the variable is removed from the model. A significant change shows the variable helps improve the overall model fit.

Table 13: Type 3 effects for the SB duration model

Group	Variable	Type 3 chi square	Levels
Benefit information	BenDurSB	*** 65.7	
	PreBen	*** 109.8	6
	PreBenDur	*** 74.7	
	BenDurTotal	*** 213.6	
Demographics	Age	*** 28.9	
Interventions	MCstatus	*** 23,365.5	13
Duration	DurIntCat	*** 1,930.5	100
Education history	EducationLevel	*** 30.7	8
	SALtime	*** 36.7	
Family status	ChildAge	*** 602.7	4
	NumChild	*** 794.1	4
Health status	NumIncap	*** 78.0	
	PrimaryIncapacity	*** 859.2	13
Labour market	Month	*** 384.9	12
Migrant status	EnglishPrefered	*** 38.5	2
	TimeInNZ	*** 207.4	7

*: p value <0.1, **: p value <0.05, ***: p value <0.001.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Table 14 summarises those variables included in the full model. For each variable, we have converted the beta estimate into an odds ratio[6], and indicated the mean value or proportion in the case of categorical variables (in the average column in **Error! Reference source not found.**). The o dds ratio is designed to show the change in probability of an event, in this case ending an unemployment benefit spell. A value above 1 indicates an increase in the probability and below 1 a decrease in the probability. For categorical variables such as previous benefit, the odds ratio is relative to the reference group (these have an odds ratio of 1 in the tables). For continuous variables, we divided the beta estimate by two times the standard deviation of the variable to enable comparison of the relative importance of categorical and continuous variables.

Table 14: Model parameter estimates for SB duration mode

Group	Parameter	Level	Estimate	Odds
Intercept	Intercept		*** -2.994	0.05009
Benefit information	BenDurSB		*** 0.000	0.95163
	PreBen	DPB related	*** 0.141	1.15156
		IB	*** 0.350	1.41888
		JSA IYB	-0.006	0.99399
		No benefit	** 0.037	1.03819
		SB related	*** -0.069	0.93351
		UB related	0.000	1
	PreBenDur		*** 0.000	0.95404
	BenDurTotal		*** 0.000	0.97346
Demographics	Age		*** -0.003	0.96819
Interventions	MCstatus	Med Cert 01	*** 1.808	6.0991
		Med Cert 01 FF	*** 1.980	7.24358
		Med Cert 02	*** 2.327	10.2469
		Med Cert 02 FF	*** 2.168	8.73876
		Med Cert 03	*** 2.416	11.1994
		Med Cert 03 FF	*** 2.390	10.9093
		Med Cert 04	*** 2.491	12.0726
		Med Cert 04 FF	*** 2.486	12.0132
		Med Cert 05	*** 2.608	13.5785
		Med Cert 05 FF	*** 2.524	12.4735
		Med Cert 06+	*** 2.647	14.105
		Med Cert 06+ FF	*** 2.704	14.9379
		Med Cert None	0.000	1
Duration	DurIntCat	Period 01	*** -0.947	0.38774
		Period 01 FF	*** -1.010	0.36432
		Period 02	0.046	1.04704
		Period 02 FF	** -0.448	0.63904
		Period 03	** 0.452	1.57205
		Period 03 FF	0.377	1.4578
		Period 04	** 0.525	1.6902
		Period 04 FF	** 0.441	1.55484
		Period 05	0.326	1.38578
		Period 05 FF	0.306	1.35856
		Period 06	*** 0.696	2.00546
		Period 06 FF	** 0.588	1.79953
		Period 07	*** 0.719	2.05175
		Period 07 FF	** 0.530	1.69809
		Period 08	*** 0.842	2.32086
		Period 08 FF	0.365	1.43981

[6] Note the odds ratio is the change in probability of an event occurring, not the probability itself.

Group	Parameter	Level	Estimate	Odds
		Period 09	*** 0.822	2.27617
		Period 09 FF	0.290	1.33622
		Period 10	*** 0.856	2.35301
		Period 10 FF	** 0.631	1.87984
		Period 11	*** 0.944	2.56899
		Period 11 FF	*** 0.693	2.00036
		Period 12	*** 0.942	2.56616
		Period 12 FF	*** 0.827	2.2854
		Period 13	*** 0.990	2.69247
		Period 13 FF	*** 0.778	2.17721
		Period 14	*** 0.953	2.59256
		Period 14 FF	*** 0.873	2.39449
		Period 15	*** 0.974	2.64772
		Period 15 FF	*** 0.863	2.36935
		Period 16	*** 0.893	2.44201
		Period 16 FF	*** 0.875	2.39892
		Period 17	*** 0.740	2.09497
		Period 17 FF	*** 0.801	2.22682
		Period 18	** 0.587	1.79891
		Period 18 FF	** 0.640	1.89561
		Period 19	*** 0.687	1.98787
		Period 19 FF	*** 0.748	2.11311
		Period 20	*** 0.704	2.02224
		Period 20 FF	*** 0.684	1.9819
		Period 21	** 0.608	1.83761
		Period 21 FF	** 0.565	1.75885
		Period 22	*** 0.827	2.28659
		Period 22 FF	0.366	1.44255
		Period 23	*** 0.628	1.87433
		Period 23 FF	** 0.456	1.57783
		Period 24	** 0.556	1.74446
		Period 24 FF	** 0.504	1.65515
		Period 25	*** 0.721	2.05609
		Period 25 FF	** 0.547	1.72789
		Period 26	** 0.610	1.84095
		Period 26 FF	** 0.597	1.81662
		Period 27	** 0.580	1.78628
		Period 27 FF	*** 0.717	2.04756
		Period 28	** 0.554	1.73948
		Period 28 FF	0.436	1.54711
		Period 29	** 0.519	1.6806
		Period 29 FF	** 0.554	1.74082
		Period 30	** 0.444	1.5588
		Period 30 FF	0.091	1.09578
		Period 31	** 0.535	1.70672
		Period 31 FF	0.427	1.5325
		Period 32	** 0.493	1.63751
		Period 32 FF	0.238	1.26835
		Period 33	*** 0.633	1.88258
		Period 33 FF	** 0.586	1.79698
		Period 34	** 0.528	1.69537
		Period 34 FF	-0.057	0.94449
		Period 35	** 0.470	1.59945
		Period 35 FF	0.315	1.37002
		Period 36	** 0.475	1.60744

Group	Parameter	Level	Estimate	Odds
		Period 36 FF	0.159	1.17291
		Period 37	0.386	1.47177
		Period 37 FF	-0.028	0.97258
		Period 38	0.290	1.33621
		Period 38 FF	0.243	1.27503
		Period 39	0.292	1.33884
		Period 39 FF	0.213	1.23777
		Period 40	0.352	1.42134
		Period 40 FF	0.391	1.47905
		Period 41	0.352	1.42193
		Period 41 FF	0.230	1.25884
		Period 42	0.153	1.16582
		Period 42 FF	0.330	1.39065
		Period 43	0.098	1.10242
		Period 43 FF	0.045	1.04606
		Period 44	0.098	1.1028
		Period 44 FF	-0.015	0.98537
		Period 45	0.176	1.19247
		Period 45 FF	** 0.461	1.5863
		Period 46	0.335	1.39852
		Period 46 FF	0.232	1.26174
		Period 47	0.260	1.29659
		Period 47 FF	-0.099	0.90544
		Period 48	-0.011	0.9887
		Period 48 FF	-0.040	0.96031
		Period 49	0.188	1.20713
		Period 49 FF	0.127	1.13499
		Period 50	0.077	1.08048
		Period 50 FF	0.000	1
Education history	EducationLevel	A: No qualifications	0.000	1
		B: NQF 1: <80 credit	** 0.042	1.04273
		C: NQF 1: 80+ credit	** 0.066	1.0683
		D: NQF 2: 80+ credit	** 0.080	1.08359
		E: NQF 3: 80+ credit	** 0.075	1.07771
		F: NQF 4: 72+ credit	** 0.069	1.07163
		G: Degree profession	*** 0.180	1.1968
		H: Unspecified	*** 0.074	1.07667
	SALtime		*** 0.000	1.04462
Family status	ChildAge	<5 years	*** 0.355	1.42563
		5-<14 years	*** -0.175	0.8396
		14+ years	*** -0.574	0.56343
		No child	0.000	1
	NumChild	1 child	*** 0.834	2.30312
		2 children	*** 0.202	1.22382
		3+ children	0.000	1
		No child	0.000	1
Health status	NumIncap		*** -0.094	0.91002
	PrimaryIncapacity	Accident	*** 0.101	1.10644
		Cancer	*** 0.245	1.27745
		Cardiovascular	0.041	1.04203
		Congenital	-0.077	0.92616
		Intellectual	0.199	1.22017
		Musculoskeletal	*** -0.226	0.79772
		Nervous sensory	*** -0.231	0.79344
		None	0.000	1

Group	Parameter	Level	Estimate	Odds
		Other psychological	*** -0.293	0.74629
		Other unspecified	*** 0.087	1.09066
		Pregnancy	*** 0.354	1.4247
		Schizophrenia	*** -0.286	0.7512
		Substance abuse	*** -0.218	0.80375
Migrant status	EnglishPrefered	Yes	0.000	1
		No	*** -0.366	0.69349
	TimeInNZ	<1 yr	*** -0.500	0.60675
		1-2 yrs	*** -0.784	0.45658
		2-4 yrs	*** -0.529	0.58931
		4-8 yrs	*** -0.305	0.73739
		8-12 yrs	*** -0.234	0.79171
		12+ yrs	*** -0.098	0.90639
		New Zealand	0.000	1
Part-time work	TotalEarnings		*** 0.001	1.00088
Scale	Scale		1.000	2.71828
Labour market	Month	January	*** 0.138	1.14836
		February	*** 0.343	1.40957
		March	*** 0.166	1.18095
		April	0.032	1.03245
		May	-0.010	0.98963
		June	0.000	0.99998
		July	*** 0.126	1.13426
		August	0.017	1.01746
		September	0.000	1
		October	0.022	1.02197
		November	0.022	1.022
		December	*** -0.254	0.77595
Labour market Ben	ExitsSE		*** -1.682	0.18595
	TLA	Ashburton	*** 0.364	1.4396
		Auckland City	0.000	1
		Buller	** -0.346	0.7072
		Christchurch City	*** 0.165	1.17962
		Clutha	0.214	1.23855
		Dunedin City	*** 0.124	1.13187
		Far North	-0.025	0.97554
		Franklin	** 0.143	1.1533
		Gisborne	*** 0.218	1.24359
		Grey	** 0.200	1.22117
		Hamilton City	*** 0.295	1.34307
		Hastings	*** 0.265	1.30342
		Hauraki	*** 0.267	1.30546
		Horowhenua	*** 0.229	1.25756
		Hutt City	** 0.107	1.11288
		Invercargill City	*** 0.396	1.48634
		Kaipara	-0.052	0.94905
		Kapiti Coast	*** 0.310	1.36336
		Kawerau	0.131	1.13971
		Manawatu	0.008	1.00772
		Manukau City	0.015	1.0153
		Marlborough	*** 0.293	1.34049
		Masterton	*** 0.229	1.25766
		Matamata-Piako	0.111	1.1178
		Napier City	*** 0.243	1.27531
		Nelson City	** 0.147	1.15806

Group	Parameter	Level	Estimate	Odds
		New Plymouth	*** 0.387	1.4731
		North Shore City	*** 0.177	1.19413
		Opotiki	** 0.288	1.33359
		Otago Queenstown	*** 0.458	1.58015
		Palmerston North City	*** 0.147	1.15887
		Papakura	*** 0.216	1.24051
		Porirua City	0.015	1.01478
		Rangitikei	*** 0.291	1.33798
		Rodney	*** 0.176	1.19205
		Rotorua	*** 0.253	1.28836
		Ruapehu Waitomo Taupo	*** 0.229	1.25711
		South Taranaki	*** 0.337	1.40008
		South Waikato	** 0.200	1.22115
		Stratford	0.066	1.06828
		Tararua	** 0.232	1.26072
		Tasman	*** 0.274	1.3147
		Tauranga West BoP	*** 0.374	1.45287
		Thames-Coromandel	*** 0.226	1.25348
		Timaru	*** 0.361	1.43453
		Upper Hutt City	*** 0.742	2.09939
		Waikato	*** 0.258	1.29435
		Waimakariri	*** 0.247	1.28034
		Waipa	0.078	1.08089
		Wairoa	-0.023	0.97759
		Waitakere City	*** 0.132	1.14083
		Waitaki	*** 0.331	1.39167
		Wellington City	0.057	1.05913
		Whakatane	*** 0.302	1.35233
		Whanganui	*** 0.187	1.2057
		Whangarei	0.005	1.0047

*: p value <0.1, **: p value <0.05, ***: p value <0.001.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

As noted previously, the baseline hazard is non-linear. The impact of the change in the medical certificate process is reflected in the MCstatus and DurIntCat variables, with the change in process from May 2011 identified by the 'FF' suffix. Therefore, parameter estimates for each variable were estimated separately for the period before and after May 2011 within the overall model.

The remaining variables show an expected pattern.

Labour market: an increased regional benefit exit rate makes exits more likely.

Seasonality: during the first quarter of the calendar year exits are more likely.

Location: there is considerable variation between territorial authority locations in changing the likelihood of exits. Of note is that often provincial and rural locations are associated with greater likelihood of exit than the main centres.

Health status: the number of identified incapacities reduces the probability of exit. Exit rates are highest for those with cancer and pregnancy. For pregnancy, these are transfers to sole parent benefits. The least likely to exit are clients with mental health conditions.

Benefit history: the likelihood of exiting SB falls with longer durations on benefit. What prior benefit a client was on also plays a role; of interest is the increased likelihood of exit for clients moving from IB. Looking at the probability of exit from any benefit model shows these exits are from main benefit rather than transfers back to IB. The other surprising finding is the low exit probability for those with no prior benefit, who have the lowest probability of exiting SB over the first year.

Age group: the likelihood of exiting decreases with age.

Family: having one child shows an increased likelihood of exiting SB. However, looking at the time on any benefits shows this increase is because of transfers rather than exits from benefit.

Education: there is increased likelihood of exiting with those who are higher educated, especially those with tertiary or above, as well as those who have recently completed tertiary study. If a client is currently studying while on benefit, this increases the likelihood of exiting SB.

Working part-time: the level of part-time earnings is associated with increased likelihood of exit.

Migrant status: migrants in general have lower likelihood of exiting than non-migrants.

Duration on any main benefit

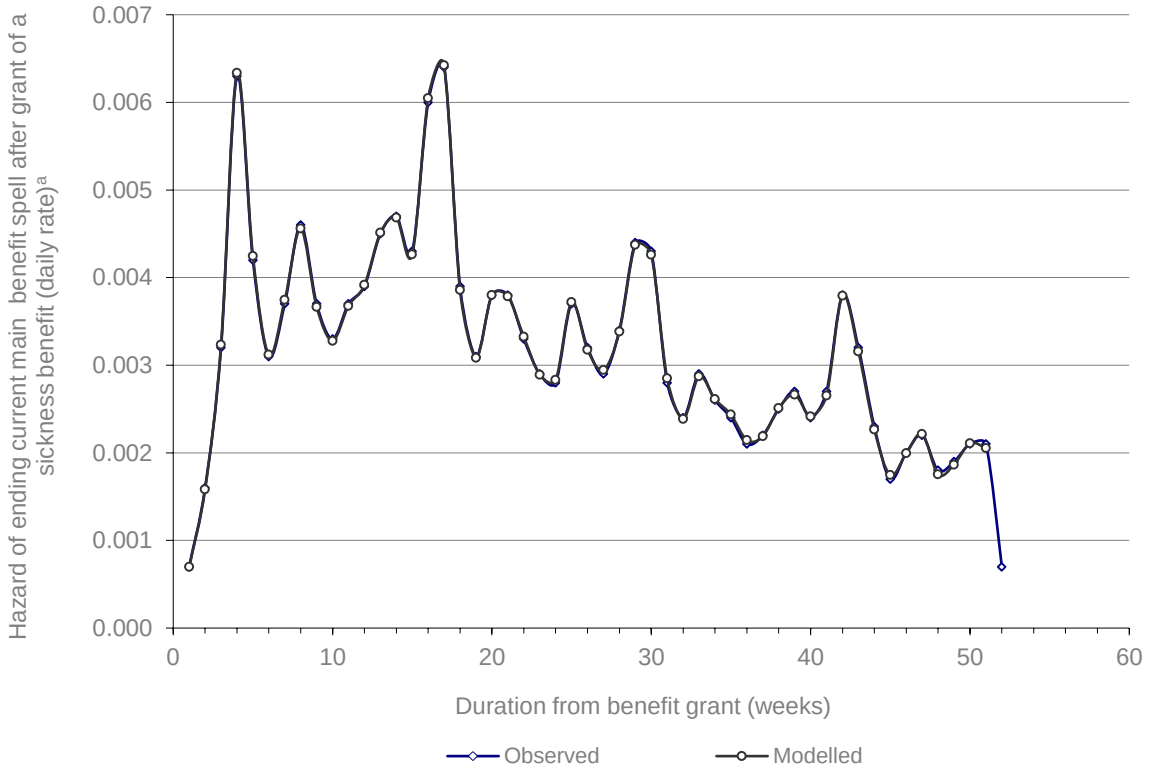
Population and analysis sample

The duration analysis on exits from any main benefit uses the same sample as the duration analysis for exits from unemployment benefit. The difference is in the spell duration, where spells are measured until a client exits benefit completely, rather than exit from unemployment benefit only.

Final model fit

Figure 16 shows the actual and estimated hazard rate for the full model of hazard of exiting from main benefit.

Figure 16: Actual and estimated hazard rate for duration on main benefit



What influences time on main benefit?

The full model for the duration on main benefit model contained 24 variables; the type 3 effects are summarised in Table 15 below.

Table 15: Type 3 effects for the main benefit duration model

Group	Variable	Type 3 chi square	Levels
Benefit information	BenDurIB	** 4.5	
	BenDurSB	*** 9.9	
	BenDurUB	*** 16.9	
	CurrentServ	*** 396.6	4
	PreBen	** 13.5	6
	PreBenDur	*** 12.2	
	BenDurTotal	** 6.1	
Demographics	Age	*** 16.6	
	Gender	*** 8.4	2
Interventions	MCstatus	*** 2,780.9	13
Duration	DurIntCat	*** 354.1	100
Education history	EducationLevel	*** 38.4	8
(blank)	TimeLastSAL	** 5.7	
Family status	ChildAge	2.4	4
	NumChild	** 8.2	4
	Partner	*** 119.1	2
Health status	NumIncap	** 4.3	
	PrimaryIncapacity	*** 242.3	13
Labour market	Month	*** 165.5	12
Migrant status	EnglishPrefered	*** 8.7	2
	TimeInNZ	** 15.1	7
Part-time work	TotalEarnings	*** 32.8	
Labour market Ben	EntriesSE	*** 12.0	
	TLA	*** 165.5	56

*: p value <0.1, **: p value <0.05, ***: p value <0.001.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Table 16 summarises those variables included in the model.

Table 16: Selected variable odds ratio estimates for main benefit duration mode

Group	Parameter	Level	Estimate	Odds
Intercept	Intercept		*** -3.801	0.02236
Benefit information	BenDurIB		** 0.000	0.94428
	BenDurSB		*** 0.000	0.93899
	BenDurUB		*** 0.000	0.95505
	CurrentServ	DPB related	*** -2.417	0.08918
		IB	*** -1.207	0.29924
		SB related	*** 0.399	1.48963
		UB related	0.000	1
	PreBen	DPB related	0.130	1.1384
		IB	** 0.294	1.3418
		JSA IYB	-0.040	0.96076
		No benefit	0.015	1.01538
		SB related	** -0.133	0.87562
		UB related	0.000	1
	PreBenDur		*** 0.000	0.93445
	BenDurTotal		** 0.000	0.98131
Demographics	Age		*** -0.010	0.90924
	Gender	Female	*** -0.130	0.87814
		Male	0.000	1

Group	Parameter	Level	Estimate	Odds
Interventions	MCstatus	Med Cert 01	*** 2.281	9.7824
		Med Cert 01 FF	*** 2.574	13.1155
		Med Cert 02	*** 2.552	12.8284
		Med Cert 02 FF	*** 2.427	11.328
		Med Cert 03	*** 2.401	11.0301
		Med Cert 03 FF	*** 2.518	12.409
		Med Cert 04	*** 2.223	9.23751
		Med Cert 04 FF	*** 2.450	11.5922
		Med Cert 05	*** 2.587	13.2953
		Med Cert 05 FF	*** 2.394	10.9601
		Med Cert 06+	*** 2.100	8.1693
		Med Cert 06+ FF	*** 2.463	11.7401
		Med Cert None	0.000	1
Duration	DurIntCat	Period 01	-1.134	0.3219
		Period 01 FF	-1.300	0.27264
		Period 02	-0.032	0.96844
		Period 02 FF	-0.892	0.40964
		Period 03	0.336	1.39884
		Period 03 FF	0.057	1.0584
		Period 04	0.404	1.49807
		Period 04 FF	0.174	1.18986
		Period 05	0.351	1.42059
		Period 05 FF	0.181	1.19858
		Period 06	0.770	2.15902
		Period 06 FF	0.952	2.59143
		Period 07	0.789	2.20213
		Period 07 FF	0.495	1.64103
		Period 08	1.022	2.77927
		Period 08 FF	0.649	1.91425
		Period 09	1.127	3.08528
		Period 09 FF	0.473	1.60541
		Period 10	1.023	2.78258
		Period 10 FF	0.540	1.71572
		Period 11	1.003	2.72659
		Period 11 FF	** 1.233	3.43208
		Period 12	1.156	3.17849
		Period 12 FF	0.992	2.69779
		Period 13	1.153	3.16765
		Period 13 FF	0.053	1.05417
		Period 14	1.164	3.20138
		Period 14 FF	0.664	1.94324
		Period 15	** 1.311	3.7111
		Period 15 FF	1.058	2.88106
		Period 16	0.969	2.63428
		Period 16 FF	1.009	2.74225
		Period 17	0.743	2.10254
		Period 17 FF	0.743	2.10137
		Period 18	0.834	2.30244
		Period 18 FF	0.876	2.40039
		Period 19	0.871	2.3891
		Period 19 FF	0.776	2.17195
		Period 20	0.926	2.52341
		Period 20 FF	0.844	2.3267
		Period 21	1.075	2.92901
		Period 21 FF	0.834	2.3023

Group	Parameter	Level	Estimate	Odds
		Period 22	0.967	2.6303
		Period 22 FF	1.148	3.15183
		Period 23	0.928	2.5282
		Period 23 FF	0.933	2.54118
		Period 24	** 1.212	3.36113
		Period 24 FF	0.489	1.63048
		Period 25	0.905	2.47289
		Period 25 FF	0.948	2.57954
		Period 26	1.103	3.01396
		Period 26 FF	0.703	2.01907
		Period 27	1.179	3.25068
		Period 27 FF	** 1.314	3.72234
		Period 28	0.886	2.42468
		Period 28 FF	0.892	2.43988
		Period 29	0.742	2.09995
		Period 29 FF	0.791	2.20494
		Period 30	0.833	2.30033
		Period 30 FF	0.977	2.65538
		Period 31	1.072	2.92164
		Period 31 FF	1.028	2.7948
		Period 32	0.595	1.8129
		Period 32 FF	0.938	2.55454
		Period 33	0.752	2.12037
		Period 33 FF	1.076	2.93398
		Period 34	0.945	2.57303
		Period 34 FF	0.811	2.25074
		Period 35	0.273	1.31356
		Period 35 FF	0.241	1.27297
		Period 36	0.825	2.28212
		Period 36 FF	0.845	2.32867
		Period 37	0.975	2.65058
		Period 37 FF	0.165	1.17953
		Period 38	0.696	2.00643
		Period 38 FF	0.557	1.74525
		Period 39	0.464	1.58987
		Period 39 FF	0.410	1.50668
		Period 40	0.812	2.2533
		Period 40 FF	1.131	3.09873
		Period 41	0.321	1.37847
		Period 41 FF	0.333	1.39551
		Period 42	0.317	1.37341
		Period 42 FF	0.483	1.62097
		Period 43	0.272	1.31216
		Period 43 FF	-0.509	0.60105
		Period 44	-0.328	0.7206
		Period 44 FF	0.660	1.93523
		Period 45	0.421	1.52337
		Period 45 FF	** 1.364	3.91087
		Period 46	0.639	1.89457
		Period 46 FF	0.662	1.93936
		Period 47	0.147	1.15863
		Period 47 FF	0.811	2.25047
		Period 48	0.385	1.46909
		Period 48 FF	0.226	1.25388
		Period 49	0.458	1.58073

Group	Parameter	Level	Estimate	Odds
		Period 49 FF	0.614	1.84806
		Period 50	0.562	1.7535
		Period 50 FF	0.000	1
Education history	EducationLevel	A: No qualifications	0.000	1
		B: NQF 1: <80 credit	0.014	1.01448
		C: NQF 1: 80+ credit	0.053	1.05481
		D: NQF 2: 80+ credit	*** 0.253	1.28809
		E: NQF 3: 80+ credit	*** 0.234	1.26334
		F: NQF 4: 72+ credit	** 0.166	1.1807
		G: Degree profession	*** 0.380	1.46273
		H: Unspecified	*** 0.314	1.36835
(blank)	TimeLastSAL		** 0.000	1.00005
Family status	ChildAge	<5 years	0.137	1.14707
		5-<14 years	0.195	1.21563
		14+ years	0.166	1.18065
		No child	0.000	1
		1 child	** -0.226	0.79751
		2 children	-0.165	0.8476
		3+ children	0.000	1
		No child	0.000	1
	Partner	Yes	*** -1.130	0.32306
		No	0.000	1
Health status	NumIncap		** -0.072	0.9306
	PrimaryIncapacity	Accident	*** -1.156	0.31489
		Cancer	*** -1.006	0.36553
		Cardiovascular	*** -1.490	0.22529
		Congenital	*** -1.579	0.20617
		Intellectual	-0.705	0.49409
		Musculoskeletal	*** -1.501	0.22284
		Nervous sensory	*** -1.741	0.17527
		None	0.000	1
		Other psychological	*** -1.505	0.22193
		Other unspecified	*** -1.281	0.27772
		Pregnancy	*** -1.642	0.19351
		Schizophrenia	*** -1.817	0.16244
		Substance abuse	*** -1.528	0.21707
Migrant status	EnglishPrefered	Yes	0.000	1
		No	*** -0.630	0.53244
	TimeInNZ	<1 yr	-1.431	0.23896
		1-2 yrs	** -1.295	0.27402
		2-4 yrs	** -0.467	0.62675
		4-8 yrs	0.016	1.01619
		8-12 yrs	0.028	1.02867
		12+ yrs	0.008	1.00792
		New Zealand	0.000	1
Part-time work	TotalEarnings		*** 0.001	1.00136
Scale	Scale		1.000	2.71828
Labour market	Month	January	0.114	1.12059
		February	*** 0.611	1.84146
		March	*** 0.266	1.30463
		April	0.119	1.12658
		May	0.051	1.05261
		June	-0.076	0.9271
		July	** 0.202	1.22444
		August	-0.118	0.88896

Group	Parameter	Level	Estimate	Odds
		September	0.000	1
		October	-0.081	0.92252
		November	-0.056	0.94543
		December	*** -0.440	0.64404
Labour market Ben	EntriesSE		*** -0.464	0.62863
	TLA	Ashburton	** 0.773	2.16525
		Auckland City	0.000	1
		Buller	-0.491	0.61174
		Christchurch City	*** 0.258	1.29462
		Clutha	0.240	1.27068
		Dunedin City	** 0.233	1.26252
		Far North	0.107	1.11283
		Franklin	** 0.494	1.63927
		Gisborne	** 0.248	1.28188
		Grey	** 0.524	1.6894
		Hamilton City	** 0.184	1.20144
		Hastings	** 0.343	1.40946
		Hauraki	0.143	1.15348
		Horowhenua	-0.236	0.78951
		Hutt City	-0.034	0.9662
		Invercargill City	0.283	1.32664
		Kaipara	*** 1.068	2.90842
		Kapiti Coast	-0.091	0.91301
		Kawerau	** 0.665	1.9444
		Manawatu	-0.123	0.88463
		Manukau City	-0.103	0.90247
		Marlborough	*** 0.783	2.18706
		Masterton	-0.068	0.93472
		Matamata-Piako	0.158	1.17063
		Napier City	** 0.298	1.34651
		Nelson City	*** 0.582	1.79049
		New Plymouth	*** 0.639	1.8943
		North Shore City	0.078	1.08105
		Opotiki	*** 1.067	2.90603
		Otago Queenstown	*** 0.908	2.47842
		Palmerston North City	0.100	1.10525
		Papakura	-0.122	0.8851
		Porirua City	-0.263	0.76898
		Rangitikei	** 0.554	1.74091
		Rodney	** 0.340	1.40521
		Rotorua	0.190	1.2094
		Ruapehu Waitomo Taupo	** 0.303	1.3537
		South Taranaki	-0.330	0.71869
		South Waikato	0.327	1.38726
		Stratford	-0.875	0.41705
		Tararua	-0.113	0.89329
		Tasman	** 0.338	1.40169
		Tauranga West BoP	*** 0.505	1.6572
		Thames-Coromandel	0.283	1.32695
		Timaru	*** 0.701	2.01617
		Upper Hutt City	*** 0.746	2.10867
		Waikato	-0.132	0.87619
		Waimakariri	-0.051	0.95069
		Waipa	0.257	1.29248
		Wairoa	0.045	1.0465

Group	Parameter	Level	Estimate	Odds
		Waitakere City	0.104	1.10923
		Waitaki	0.513	1.66967
		Wellington City	0.034	1.03499
		Whakatane	** 0.426	1.53101
		Whanganui	0.005	1.00546
		Whangarei	-0.236	0.78964

*: p value <0.1, **: p value <0.05, ***: p value <0.001.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

As noted previously, the baseline hazard is non-linear. The impact of the change in medical certificate process is reflected in the MCstatus and DurIntCat variables, with the change in process from May 2011 identified by the 'FF' suffix. Therefore, parameter estimates for each variable were estimated separately for the period before and after May 2011 within the overall model.

The remaining variables show an expected pattern.

Labour market: an increased regional entry rate reduces likelihood of exit.

Seasonality: during the first quarter of the calendar year the likelihood of exiting increases, while the period to Christmas decreases the likelihood.

Location: there is considerable variation between territorial authority locations in the likelihood of exiting. Of note is that often provincial and rural locations have greater likelihood of exit than the main centres.

Benefit history: longer previous benefit receipt, coming onto benefit at a young age and clients on Invalid's and sole parent benefits are less likely to exit from main benefit.

Age group: probability of exiting benefit increases with age.

Ethnicity: of identified ethnicities, Māori have the lowest likelihood of exiting compared to the other three groups, with Europeans the most likely.

Gender: women are less likely to exit main benefit than men.

Education: there is increased likelihood of exiting with those who are higher educated, especially those with tertiary qualifications.

Working part-time: the level of part-time earnings is associated with greater likelihood of exit.

Migrant status: new migrants in general have lower likelihood of exiting than non-migrants.

Duration off benefit after exiting main benefit

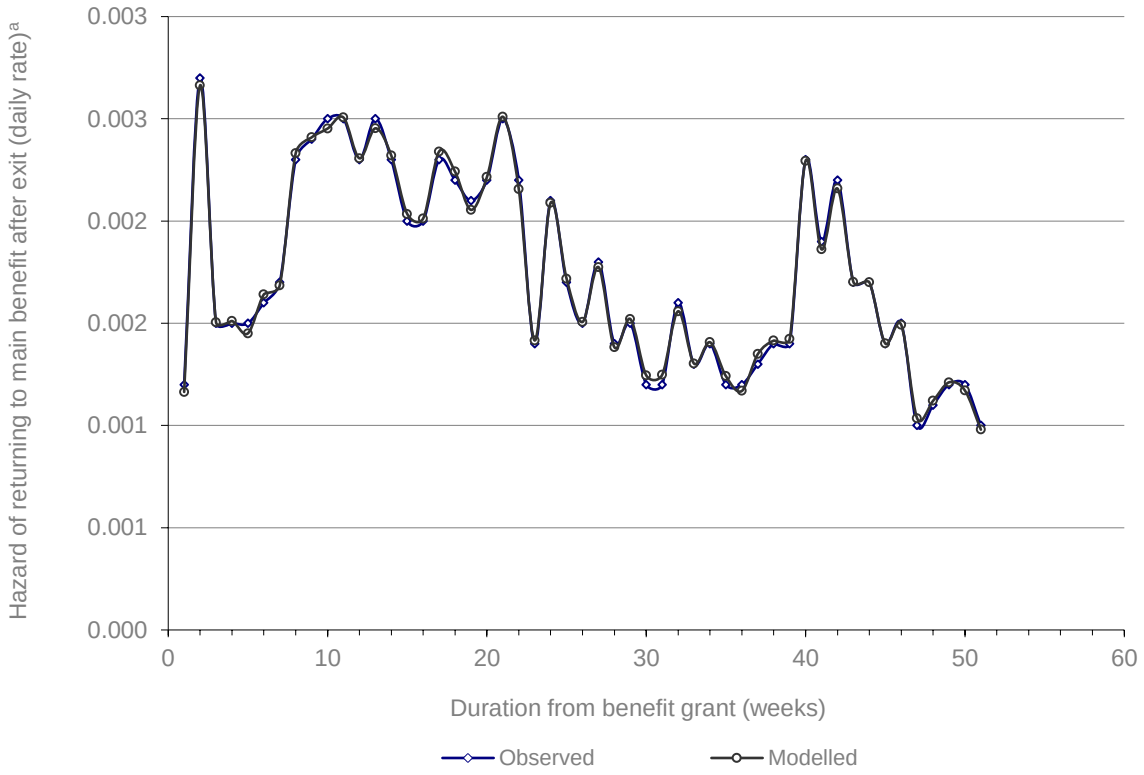
Population and analysis sample

The duration model is based on the sample of main benefit spell with an uncensored exit. For this reason the number of off-benefit spells is smaller than in the previous two models.

Final model fit

Figure 17 shows the actual and estimated hazard rate for the full model of hazard of returning to main benefit.

Figure 17: Actual and estimated hazard rate for duration off main benefit



What influences time off main benefit?

The full model for the duration on off main benefit model contained 21 variables; the type 3 effects are summarised in Table 17 below.

Table 17: Type 3 effects for the off main benefit duration model

Group	Variable	Type 3 chi square	Levels
Benefit information	BenDurSB	*** 12.3	
	BenDurUB	*** 25.4	
	PreBen	** 12.8	6
	StBenDur	** 3.4	
	StBenType	*** 172.4	5
	PreOffBenDur	*** 34.5	
Demographics	AgeGroup	*** 47.4	11
	Ethnicity	*** 28.5	5
Interventions	MCstatusAtExit	*** 29.5	13
Duration	DurIntCat	*** 303.2	100
Education history	EducationLevel	*** 76.9	8
(blank)	TimeLastSAL	*** 43.3	
Family status	StChildAge	1.2	4
	StNumChild	*** 13.4	4
Health status	StPrimaryIncapacity	*** 33.3	13
Part-time work	StTotalEarnings	*** 15.0	
Prison	TimeSincePrison	*** 27.4	10
Labour market	Month	*** 158.7	12
Labour market Ben	ExitsSE	*** 1,463.5	
	TLA	*** 319.6	56

*: p value <0.1, **: p value <0.05, ***: p value <0.001.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Error! Reference source not found. 18 summarises those variables included in the model. The duration off benefit has the fewest parameters, largely because we know less about a client's circumstances once they have left benefit.

Table 18: Selected variable odds ratio estimates for duration off benefit model

Group	Parameter	Level	Estimate	Odds
Intercept	Intercept		-0.835	0.43392
Benefit information	BenDurSB		*** 0.000	1.06477
	BenDurUB		*** 0.000	1.05031
	PreBen	DPB related	** 0.222	1.24887
		IB	0.214	1.23832
		JSA IYB	0.121	1.12916
		No benefit	** 0.249	1.28237
		SB related	0.063	1.06542
		UB related	0.000	1
	StBenDur		** 0.001	1.22865
	StBenType	DPB related	*** 0.731	2.07612
		IB	0.471	1.60122
		JSA IYB	*** 4.341	76.7657
		SB related	*** 1.305	3.68776
		UB related	0.000	1
	PreOffBenDur		*** 0.000	0.93973
Demographics	AgeGroup	16-<18 yrs	** 0.862	2.36703
		18-<20 yrs	*** 0.273	1.314
		20-<25 yrs	0.000	1
		25-<30 yrs	-0.084	0.91932
		30-<35 yrs	*** -0.312	0.73205
		35-<40 yrs	*** -0.252	0.77698
		40-<45 yrs	*** -0.363	0.69541
		45-<50 yrs	*** -0.458	0.63237
		50-<55 yrs	*** -0.432	0.64907
		55-<60 yrs	** -0.386	0.68003
		60-<65 yrs	-0.272	0.76152
	Ethnicity	Māori	** 0.121	1.12873
		NZ European	0.000	1
		Pacific Island	0.117	1.12461
		Other	0.100	1.10491
		Unspecified	*** -0.724	0.48483
Interventions	MCstatusAtExit	Med Cert 01	** -0.220	0.80235
		Med Cert 01 FF	-0.243	0.78409
		Med Cert 02	** -0.161	0.85111
		Med Cert 02 FF	** -0.350	0.70498
		Med Cert 03	** -0.219	0.80301
		Med Cert 03 FF	-0.149	0.86146
		Med Cert 04	-0.126	0.88121
		Med Cert 04 FF	*** -0.540	0.58268
		Med Cert 05	-0.061	0.94087
		Med Cert 05 FF	** -0.573	0.564
		Med Cert 06+	-0.147	0.86367
		Med Cert 06+ FF	** -0.776	0.46044
		Med Cert None	0.000	1
Duration	DurIntCat	Period 01	-0.024	0.97645
		Period 01 FF	0.425	1.53025
		Period 02	** 1.031	2.80306
		Period 02 FF	** 1.416	4.12071
		Period 03	0.435	1.54556

Group	Parameter	Level	Estimate	Odds
		Period 03 FF	0.507	1.66007
		Period 04	0.216	1.2411
		Period 04 FF	0.623	1.86495
		Period 05	0.723	2.06071
		Period 05 FF	0.962	2.61574
		Period 06	0.611	1.84317
		Period 06 FF	0.519	1.67989
		Period 07	0.660	1.93383
		Period 07 FF	0.720	2.05389
		Period 08	0.725	2.06541
		Period 08 FF	** 1.035	2.81378
		Period 09	0.772	2.16369
		Period 09 FF	** 1.191	3.2895
		Period 10	0.874	2.39685
		Period 10 FF	0.772	2.16361
		Period 11	0.745	2.10613
		Period 11 FF	** 1.106	3.02081
		Period 12	0.563	1.75523
		Period 12 FF	** 1.044	2.84194
		Period 13	0.971	2.64052
		Period 13 FF	0.721	2.05592
		Period 14	0.552	1.73644
		Period 14 FF	0.682	1.97709
		Period 15	0.884	2.41999
		Period 15 FF	0.970	2.63772
		Period 16	0.688	1.99014
		Period 16 FF	0.793	2.20949
		Period 17	0.747	2.11128
		Period 17 FF	0.947	2.577
		Period 18	** 1.052	2.86382
		Period 18 FF	0.867	2.38061
		Period 19	** 1.106	3.0223
		Period 19 FF	** 1.457	4.2937
		Period 20	** 1.228	3.41356
		Period 20 FF	** 1.099	3.00254
		Period 21	** 1.216	3.37221
		Period 21 FF	** 1.310	3.70773
		Period 22	0.795	2.21422
		Period 22 FF	** 1.148	3.15074
		Period 23	** 1.081	2.94658
		Period 23 FF	0.602	1.82558
		Period 24	0.454	1.57431
		Period 24 FF	0.265	1.30313
		Period 25	0.854	2.34907
		Period 25 FF	0.638	1.89274
		Period 26	0.849	2.33682
		Period 26 FF	0.599	1.81955
		Period 27	0.488	1.62938
		Period 27 FF	0.237	1.26755
		Period 28	0.329	1.38952
		Period 28 FF	0.847	2.33217
		Period 29	0.402	1.49414
		Period 29 FF	0.611	1.84318
		Period 30	0.479	1.61369
		Period 30 FF	0.722	2.05796

Group	Parameter	Level	Estimate	Odds
		Period 31	0.822	2.2746
		Period 31 FF	-0.574	0.56337
		Period 32	0.696	2.00591
		Period 32 FF	-0.276	0.75918
		Period 33	0.621	1.86054
		Period 33 FF	0.583	1.79147
		Period 34	0.618	1.85505
		Period 34 FF	0.540	1.71556
		Period 35	0.489	1.63046
		Period 35 FF	-19.852	2.4E-09
		Period 36	0.632	1.88204
		Period 36 FF	0.508	1.66255
		Period 37	0.332	1.39431
		Period 37 FF	0.490	1.63152
		Period 38	** 1.057	2.87887
		Period 38 FF	0.852	2.34371
		Period 39	** 1.254	3.50346
		Period 39 FF	0.122	1.12979
		Period 40	*** 1.547	4.69574
		Period 40 FF	*** 1.614	5.023
		Period 41	** 1.508	4.5183
		Period 41 FF	0.793	2.20956
		Period 42	** 1.227	3.41197
		Period 42 FF	-0.319	0.72668
		Period 43	** 1.206	3.33914
		Period 43 FF	0.831	2.29659
		Period 44	** 1.005	2.73304
		Period 44 FF	0.849	2.33779
		Period 45	0.786	2.19377
		Period 45 FF	0.850	2.33973
		Period 46	0.442	1.55591
		Period 46 FF	0.293	1.34024
		Period 47	0.812	2.25157
		Period 47 FF	0.492	1.63568
		Period 48	0.438	1.54957
		Period 48 FF	-0.188	0.82881
		Period 49	0.069	1.07138
		Period 49 FF	-0.103	0.90223
		Period 50	0.571	1.77082
		Period 50 FF	0.000	1
Education history		A: No qualifications	0.000	1
		B: NQF 1: <80 credit	0.015	1.01477
		C: NQF 1: 80+ credit	-0.130	0.87796
		D: NQF 2: 80+ credit	*** -0.295	0.74438
		E: NQF 3: 80+ credit	** -0.193	0.82442
		F: NQF 4: 72+ credit	-0.098	0.90693
		G: Degree profession	*** -0.410	0.66364
		H: Unspecified	*** -0.629	0.53329
	TimeLastSAL		*** 0.000	0.99984
Family status	StChildAge	<5 years	-0.086	0.91801
		5-<14 years	-0.103	0.90224
		14+ years	-0.245	0.78235
		No child	0.000	1
	StNumChild	1 child	0.026	1.02587
		2 children	0.192	1.21133

Group	Parameter	Level	Estimate	Odds
		3+ children	0.000	1
		No child	0.000	1
Health status	StPrimaryIncapacity	Accident	** -0.182	0.8332
		Cancer	-0.426	0.65292
		Cardiovascular	0.181	1.19845
		Congenital	0.289	1.33572
		Intellectual	0.279	1.32168
		Musculoskeletal	** -0.256	0.77416
		Nervous sensory	0.127	1.13507
		None	0.000	1
		Other psychological	-0.023	0.97742
		Other unspecified	-0.121	0.88584
		Pregnancy	*** 0.273	1.31383
		Schizophrenia	0.363	1.43697
		Substance abuse	0.086	1.08939
Labour market	Month	January	-0.058	0.94355
		February	-0.105	0.90049
		March	** -0.288	0.74952
		April	** -0.226	0.79789
		May	0.140	1.15068
		June	0.132	1.14158
		July	** 0.196	1.21672
		August	0.040	1.04129
		September	0.000	1
		October	-0.057	0.94455
		November	*** 0.405	1.49935
		December	*** 0.619	1.85626
Part-time work	StTotalEarnings		*** -0.001	0.99869
Prison	TimeSincePrison	<3 months	** 0.267	1.3055
		>3-6 months	** 0.400	1.49126
		>6-12 months	*** 0.518	1.67806
		>1-2 years	*** 0.527	1.69405
		>2-4 years	0.256	1.29151
		>4-6 years	0.180	1.1973
		>6-8 years	0.101	1.10682
		>8-10 years	0.124	1.13235
		10+ years	** 0.379	1.46115
		Never	0.000	1
Scale	Scale		1.000	2.71828
Labour market Ben	ExitsSE		*** -5.133	0.0059
	TLA	Ashburton	-0.628	0.5335
		Auckland City	0.000	1
		Buller	** -0.900	0.40658
		Christchurch City	*** -0.475	0.62205
		Clutha	*** -2.080	0.12498
		Dunedin City	-0.192	0.82529
		Far North	-0.133	0.87509
		Franklin	-0.192	0.82509
		Gisborne	0.059	1.06055
		Grey	-0.565	0.56831
		Hamilton City	*** 0.628	1.87441
		Hastings	-0.053	0.94826
		Hauraki	-0.186	0.83023
		Horowhenua	-0.056	0.94596
		Hutt City	0.149	1.16123

Group	Parameter	Level	Estimate	Odds
		Invercargill City	** -0.419	0.65739
		Kaipara	** -0.955	0.38487
		Kapiti Coast	-0.266	0.76675
		Kawerau	-0.033	0.96764
		Manawatu	-0.345	0.7081
		Manukau City	** 0.219	1.24462
		Marlborough	** -0.546	0.57922
		Masterton	-0.092	0.91193
		Matamata-Piako	** -0.631	0.53203
		Napier City	-0.198	0.81997
		Nelson City	*** -0.758	0.46876
		New Plymouth	*** -0.444	0.64142
		North Shore City	0.127	1.13497
		Opotiki	0.081	1.0841
		Otago Queenstown	*** -0.888	0.41161
		Palmerston North City	-0.242	0.78509
		Papakura	0.124	1.13221
		Porirua City	-0.316	0.72892
		Rangitikei	-0.239	0.78729
		Rodney	*** 0.763	2.1451
		Rotorua	0.014	1.01456
		Ruapehu Waitomo Taupo	** -0.353	0.70244
		South Taranaki	-0.055	0.94661
		South Waikato	0.137	1.14652
		Stratford	*** -1.955	0.14157
		Tararua	** 0.692	1.99673
		Tasman	-0.113	0.89274
		Tauranga West BoP	*** 0.581	1.78856
		Thames-Coromandel	-0.150	0.86107
		Timaru	** -0.527	0.59024
		Upper Hutt City	-0.010	0.9899
		Waikato	*** 0.705	2.02465
		Waimakariri	** -0.459	0.63167
		Waipa	-0.228	0.79628
		Wairoa	*** -1.995	0.13607
		Waitakere City	*** 0.426	1.53038
		Waitaki	-0.169	0.84445
		Wellington City	*** -0.502	0.60545
		Whakatane	*** 0.728	2.07157
		Whanganui	** -0.456	0.63354
		Whangarei	-0.008	0.99204

*: p value <0.1, **: p value <0.05, ***: p value <0.001.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Quantifying the impact of the change in medical certificate expiries

Having modelled the impact of the reapplication process on the hazard rates for the three outcomes, the next stage of the analysis is to convert the fitted model into more easily understood results. In particular, we want to be able to report on the overall reduction in the time clients spend on benefit because of the change in medical certificate expiries. Presenting results in this form allows us to calculate useful metrics such as the reduction in income support expenditure and, ultimately, to estimate the net cost-benefit of the intervention.

The approach involves two linked steps:

- Calculate the impact of the medical certificate process for each of the duration models separately. Impact is estimated by using the model estimates for the expected duration for participants for each outcome and compares this to their expected duration if the medical certificate process had not changed.
- Use the duration model for time on main benefit and off benefit together to obtain an estimate of the total time clients are on benefit. By combining the two models, we can account for the impact of the policy on how long clients stay on benefit as well as on how quickly they return to benefit.

Impact on participants rather than on 'average clients'

A common approach in estimating the impact of policy using duration models is to apply the model beta estimates to a profile of an 'average' client. For example, Dalgety et al (2010) took this approach in estimating the impact of Working for Families on the duration of DPB clients on main benefit.

We take a different approach in this analysis by using the profiles of those who actually participate in the reapplication process to estimate the impact of the reapplication process. The reasons for doing so are as follows:

- The estimates are more 'intuitive', since we can say the results directly represent the experience of clients affected by the change in medical certificate process.
- By using the participants, we can check our model estimates against the observed durations of clients subject to the reapplication process. Comparing observed and modelled outcomes provides a direct means to see whether the model estimates are a reasonable reflection of what actually happened during the reapplication process.

Converting model parameter estimates into individual hazard functions

The first step is to combine the observed characteristics of clients participating in the medical certificate process with the model beta estimates to calculate the expected hazard rate for each client in each interval. From the estimated hazard, we can then calculate their expected survival and probability density function.

To achieve this we need to create a person-interval dataset that covers all intervals up to the end period of the analysis. In other words, if a client ends a spell, we need to impute their profile for the unobserved intervals until the end of the analysis period. Table 19 illustrates how we projected the client's profile for the unobserved intervals. Table 19 shows a client who exits at interval 4. However, if they did not exit, their spell would have lasted until interval 9 (the censor interval). The challenge is to impute the client profile for the unobserved spells (intervals 5-9).

Table 19: Constructing a full client interval dataset for uncensored client interval spells

Interval	1	2	3	4	5	6	7	8	9
Events	Observed			Exit	Projected				Censor
Fixed characteristics	Observed (no projection required)								
Spell duration variables	Calculated directly based on interval								
Reapplication process participation	Observed (all participants have a reapplication start date and anniversary date is a fixed variable)								
Labour market variables	Observed				Based on last observed TLA and main benefit, calculate labour market variables				
Individual time-varying characteristics	Observed				Constant based on value of last observed interval				

For fixed characteristics (those that are time invariant), we do not need to make any projections. Similarly, any duration variables (ie the piecewise duration variable) can be calculated based on the interval value.

For labour market variables, we need to make two assumptions for the projection period. These are that the client would have remained on the same main benefit and TLA location for the projected period based on the last observed interval. It is then a matter of using the benefit/TLA labour market variables for each calendar month during the projected period. Finally, for individual time-varying characteristics we assume that these characteristics remain constant during the projected period based on the value in the last observed interval. Table 20 summarises the variables used in the analysis according to the classification in Table 7.

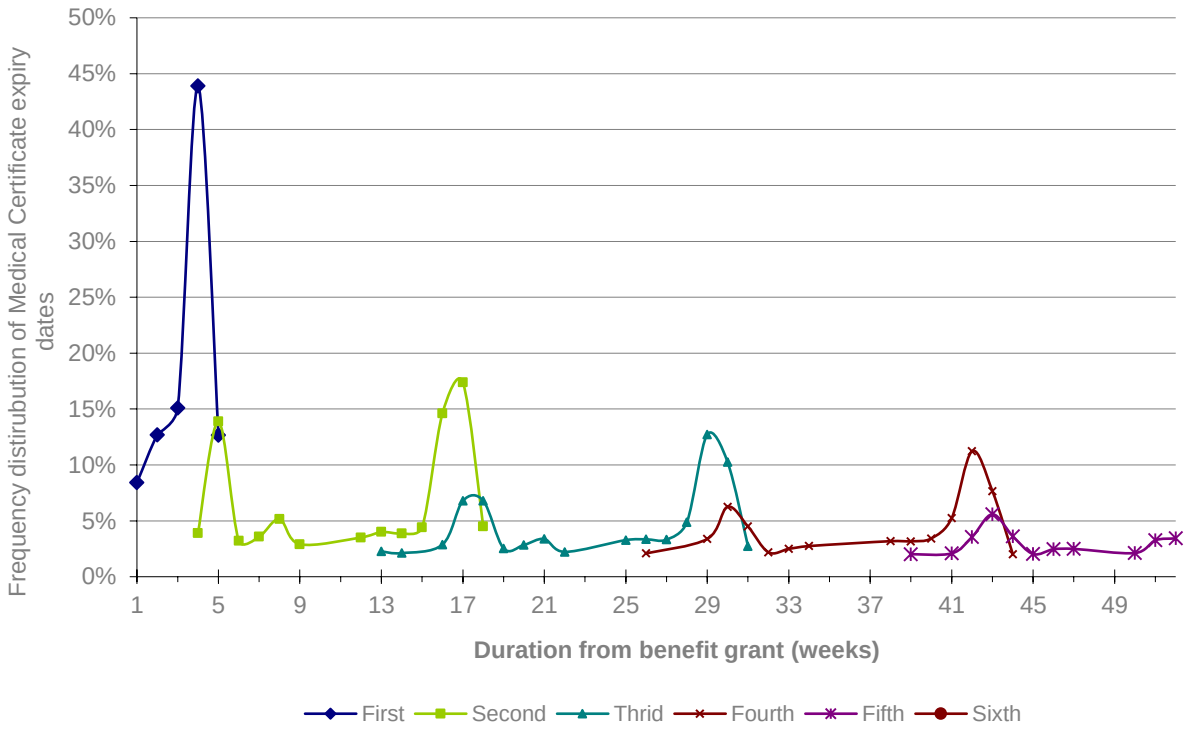
Table 20: Classification of model variables for projection of client profile for unobserved intervals

Variable type	Variable
Fixed	Age, AgeGroup, AgeFirstBenefit, AgeFirstBenefitC, Ethnicity
	BenDurDPB, BenDurIB, BenDurJSAIYB, BenDurSB, BenDurTotal, BenDurTotalC, StBenDur, StBenType, PreBen, PreBenDur
	CurrentMigrant, EnglishPrefered, Refugee, TimeInNZ
	EducationLevel, SALtimeC, TimeLastSALC,
	StartMonth
	StNumChild, StPartner
	StTotalEarnings
	ExPrisoner, TimeSincePrison
Spell duration	MCstatus
	DurIntCat
	Month
Labour market variables	EntriesSE ExitsSE UnempRate
Individual time varying characteristics	ChildAge, NumChild, Partner
	CurrentServ
	TLA
	TotalEarnings, WorkingPT,
	TertiaryStudy

Medical certificate distribution

Central to estimating the impact of the new eight-week medical certificate process is to account for the distribution of medical certificate expiries in the modelled and counterfactual state. Unlike other analysis where we can simply set the intervention parameter to zero to reflect the counterfactual scenario, here we need to simulate the distribution of medical certificates under the two policy states (before and after May 2011). To simulate these distributions we look at the frequency distribution of when each medical certificate occurred after benefit grant before the policy change in May 2011 (Figure 18).

Figure 18: Frequency distribution of medical certificates after benefit grant before May 2011



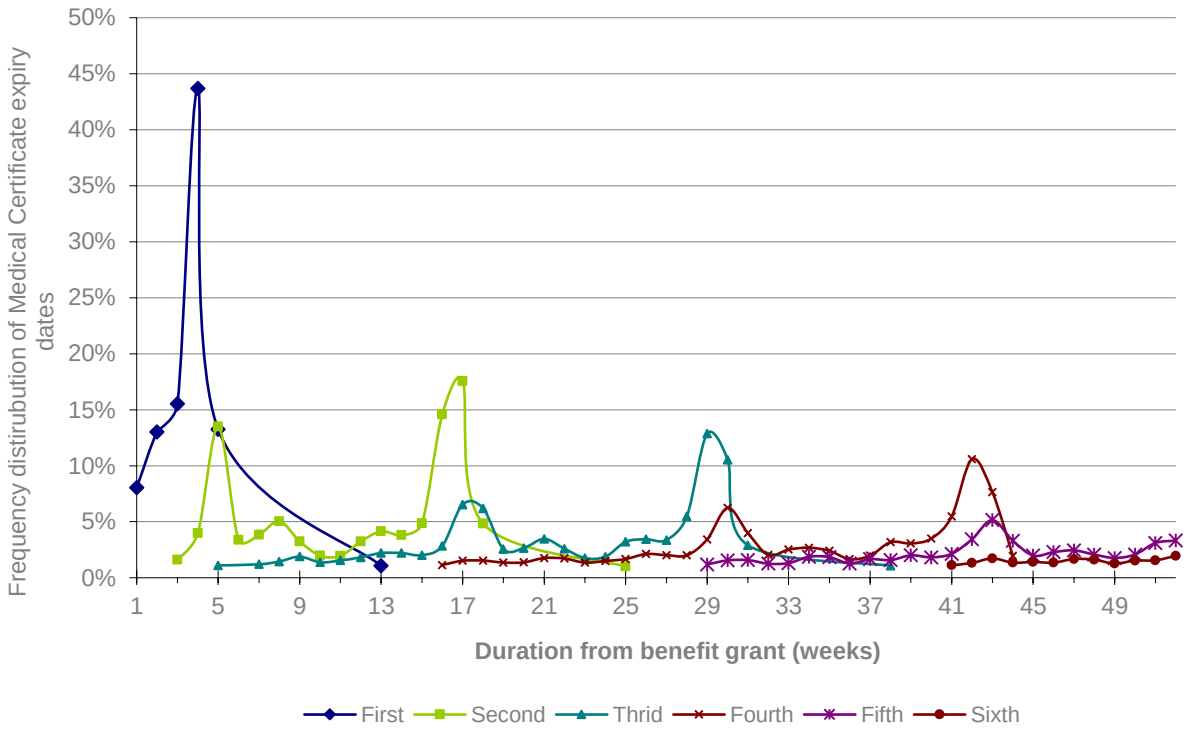
Intervals with less than 2 percent of the distribution are not shown for clarity

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

The medical certificates from one to six each have their own distributions, with later medical certificates having a wider range over a spell than earlier ones. The reason is that the timing of a medical certificate is conditional on when the previous medical certificate occurred. Therefore, to simulate the duration in the spell into which each medical certificate falls, we need to account for the duration of the previous medical certificate expiry.

To achieve this, we calculate the probability density function (PDF) for each interval after benefit grant that a medical certificate expiry would occur (eg the first medical certificate has a relatively tight distribution around four weeks). For subsequent medical certificate expiry dates, we calculate the PDF for each expiry conditional on the duration of the previous medical certificate expiry. The simulated distribution of medical certificate expiries is given in Figure 19 below. Overall, the distributions are similar to those observed in Figure 18. However, the simulated distributions will differ from the observed since the simulation has not accounted for when clients exit from SB.

Figure 19: Simulated frequency distribution of medical certificates after benefit grant before May 2011



Intervals with less than 2 percent of the distribution are not shown for clarity

Converting individual estimated hazard functions into modelled duration

Having calculated the individual hazard for each client, we then select an exit interval based on the estimated hazard. To do this we first convert the hazard for each individual spell into a probability density function (PDF). A PDF is the unconditional probability[7] that a client would have ended the spell in each interval, and can be calculated by multiplying the hazard in interval *t* by the survival rate at *t*-1. Once we have calculated the PDF for each individual client interval spell, we can randomly select an interval within that spell to represent the modelled exit interval (or censored if no interval is selected). At the end of this process, we arrive at an estimated exit interval for each client-interval spell based on the model beta parameters and the client's characteristics over that spell.

Estimating policy impact on duration on sickness and main benefit

Here we calculate two expected durations that reflect one of two states:

- **Modelled**: as clients granted SB after May 2011, that reflect observed durations
- **Counterfactual**: if clients had been subjected to the medical certificate process before May 2011.

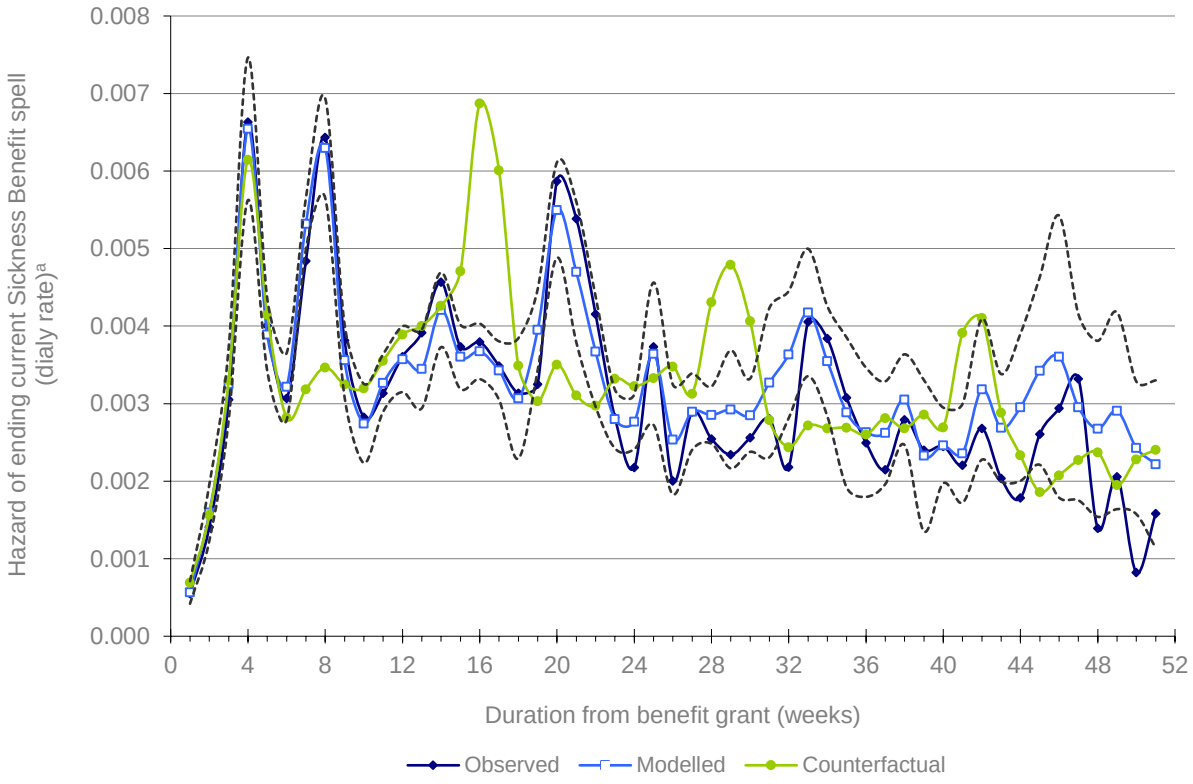
Using the simulation client-interval dataset, we apply the parameter estimates to the participants in the reapplication process. For the counterfactual state, we set the duration and medical certificate variables to their pre May 2011 values and apply their simulated medical certificate expiry dates (ie the expected distribution of medical certificate expiry dates under the pre May 2011 policy) and calculate their expected duration on each benefit (all else being equal). In other words, what would

[7] Unlike the hazard function, which is the conditional probability (ie probability of exiting at interval *t*, conditional on having survived to interval *t*-1).

the model estimate their duration on each outcome to be if they had been subject to the medical certificate process before May 2011, with all other variables remaining unchanged?

We calculate the modelled and counterfactual exit interval for each participant in the analysis. Based on these modelled and counterfactual durations we can then calculate the overall hazard and survival rates for all the participants in the same way as for the observed durations on benefit (as illustrated in Figure 20 for duration on SB). The same process is repeated for duration on any main benefit and duration off main benefit. The difference between the modelled and counterfactual hazard rates represents the impact of the reapplication process.

Figure 20: Estimated impact of the change in medical certificate expiries on hazard of exiting SB



a: Based on model parameter values and observed characteristics of those clients subject to the post May 2011 medical certificate process (modelled and counterfactual) and actual exit events (observed).
Modelled: Based on characteristics of clients who participated in the May 2011 medical certificate process using model estimates.
Counterfactual: The counterfactual was estimated by simulating medical certificate expiries for clients as if they had commenced their benefit spell before May 2011.
The dotted lines indicate the 95 percent confidence interval.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

Calculating the confidence intervals

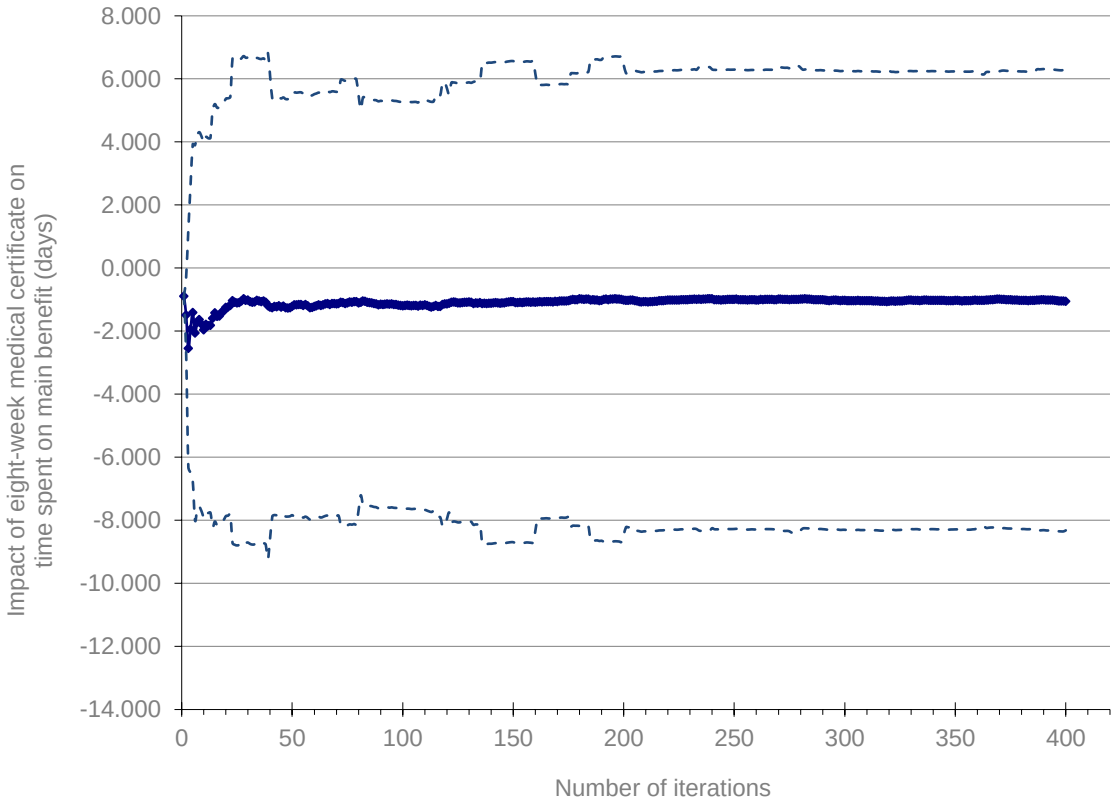
While the above calculation is relatively straightforward for the mid-point values of the beta estimates themselves, it is more difficult to convert the standard errors for the beta estimates into confidence intervals. To overcome this problem, we run a simulation model to arrive at the range of likely values that the survival curves would fall into based on the parameter space for the beta estimates (Gentle, 2003). The parameter space is defined by the model's beta estimate and associated beta covariance matrix. At the start of each iteration, we take a random draw from the parameter space for each model. Based on this random draw, we would then calculate the modelled and counterfactual durations and associated impact estimates. Repeating this process 400[8] times generates a distribution of expected values based on the parameter space. We take the

[8] Running simulations was computationally expensive and this limited the number of simulations we could practically run.

97.5 and 2.5 percent intervals of this distribution as our confidence intervals for the hazard and survival curves and associated impact estimates (as shown by the dotted lines in Figure 21).

To test whether the number of iterations is sufficient we plot the final impact estimate (time off any main benefit) by the number of simulations (Figure 21). As the number of simulations increases, we expect to see stabilisation in the central estimate and the confidence intervals. Over the first six iterations in Figure 21, we see some movement in the central estimate, but this stabilises after iteration 40. The confidence intervals show greater variation at greater number of simulations, but they also stabilise after 200 intervals.

Figure 21: Impact of change in medical certificate process by number of simulations



The confidence intervals for the model estimates reflect the uncertainty of the overall model. On the other hand, the confidence intervals for the impact reflect only the uncertainty of the beta variables for the reapplication process.

Combining model estimates

Although the individual model results are interesting, on their own they do not fully answer the main policy question as to the impact of the eight-week medical certificate on total time on benefit. In particular, we want to account for the impact of the eight-week medical certificate process on the duration on main benefit as well as the duration off benefit after exit. To achieve this goal we combine the main benefit duration model and off-benefit duration using the following steps (with a more detailed discussion below).

1. For each simulated client-interval main benefit spell, calculate the hazard of exiting main benefit and convert the hazard rate into the unconditional probability of exiting benefit in each interval.
2. Based on the estimated probability of exiting benefit in each interval, randomly select an exit interval for each client-interval spell. The selected exits represent a random draw from the expected distribution of exits from main benefit based on the model beta estimates.

3. Use the randomly generated exit from benefit to generate a simulated off-benefit client-interval spell and calculate the hazard of returning to benefit for each interval.
4. Simulate the duration off benefit for each client based on the calculated probability of returning to benefit in each interval. The selected benefit returns represent a random draw from the expected distribution of clients returning to benefit based on the model beta estimates.
5. From the combined client on- and off-benefit spells we can calculate for each interval the probability a client would be on benefit. These interval probabilities are no longer survival probabilities, since they account for clients returning to benefit after exit. What this can mean is that the probability of being on benefit can increase over intervals (which cannot happen for survival scores).

Simulated exits from main benefit

The first step is to generate the expected duration on main benefit based on the model beta estimates. To do this we calculate the probability density function (PDF) for each simulated client-interval spell. Unlike the hazard rate, the PDF represents the independent probability a client will end their spell in each interval. The PDF is a function of survival and hazard. The PDF at interval *t* is the multiple of the survival at interval *t*-1 with the hazard rate at interval *t*.

Using the PDF for each simulated client-interval spell, we randomly select an exit interval. These randomly selected exits are a draw from the expected distribution of exits based on the model beta estimates and client characteristics over the observation period. In other words, we expect them to have the same distribution as the observed pattern of off-benefit exits.

Simulated client interval off-benefit spell

The next step is to take these randomly selected exits, and create a simulated off-benefit client interval spell. To achieve this, we need to create a simulated client-interval off-benefit spell for each interval the client is on main benefit, up to the censor interval. Table 21 provides an illustration of how we create the simulated off-benefit spell. In this example, we have a simulated main benefit spell lasting for five intervals. For each on-benefit interval, we create a corresponding off-benefit client-interval spell. The client profile of each of these off-benefit spells is based on the client profile at each on-benefit interval. Therefore, the off-benefit client-interval spell for on-benefit interval 0 reflects the profile of the client at interval 0. In addition, each off-benefit interval spell is censored to match the duration of the on-benefit spell (ie five intervals in total). Note that the interval of exit and the first off-benefit interval are equivalent. To put this another way, the point at which a client exits benefit is also the point that they commence their off-benefit spell.

Table 21: Creating simulated off main benefit spells based on client profile at each main benefit interval

Simulated client-interval main benefit spell	Simulated client-interval off main benefit spell				
	Interval 0	Interval 1	Interval 2	Interval 3	Interval 4
Interval 0	Client profile based on main benefit interval 0				Censor
Interval 1	Client profile based on main benefit interval 1			Censor	
Interval 2	Based on interval 2		Censor		
Interval 3		Censor			
Interval 4	Censor				

To create these simulated off-benefit spells we need to make assumptions about the client's off-benefit profiles, since, at best, we observed only one of these off-benefit spells. However, since the off-benefit model relies primarily on fixed characteristics (observed at spell start and therefore at benefit exit), such assumptions are not as strong as they might first appear. Table 22 summarises the off-benefit model variables and notes any assumptions required to create simulated off-benefit client-interval spells.

Table 22: Off benefit duration variables and required assumptions to create simulated off benefit spells

Type	Name	Description	Assumptions
Fixed characteristics	AgeFirstBenefitC	Age at start of first benefit spell categorical	None, based on client profile
	Ethnicity	Ethnicity	
	TimeInNZ	Time since migrating to New Zealand	
	ExPrisoner	Been in prison	
	CurrentMigrant	Current migrant for income support eligibility	
	EnglishPrefered	English is the migrant's preferred language	
	EducationLevel	Highest education level	
Characteristics at start of spell	StNumChild	Number of children at spell start	None based on the client profile at main benefit exit interval. Same approach used in creating the client-interval spells for the duration model
	StPartner	With a partner on benefit at spell start	
	StTotalEarnings	Declared earnings while on benefit at spell start	
	TLA	TLA at spell start	
	CurrentServ	Current benefit at spell start	
	CWAstageAtExit	Stage in the reapplication process the client was when they exited benefit	
	AgeGroup	Age group at spell start	Recalculated using birthdate
	BenDurJSAIYB	Time on youth-related benefits at spell start	Durations are increased with each interval (ie total benefit duration at interval 0 is 300, then at interval 1 this value is 330 (ie original value plus interval duration x number of intervals)
	BenDurTotal	Time on any main benefit at spell start	
Duration-dependent variables	DurIntCat	Duration of interval categorical variable	None calculated from interval
	CWAstatus	Elapsed time since exiting during the reapplication process	
Calendar time-dependent variable	Month	Month of interval	None, start date of each interval
	EntriesSE	Seasonally adjusted monthly entries to UB benefit	None, interval start date, TLA and benefit at spell start. Same approach used in created the client-interval spells for the duration model

Based on the simulated client-interval off-benefit spell we select a representative distribution of return to benefit intervals. The steps involved are the same as for selecting intervals for exiting benefit, which we briefly summarise. We calculate the hazard of returning to benefit based on the client profile at each interval and a draw from the expected beta values form the off main benefit duration model. Based on the estimated hazard rate at each client-interval, calculate the unconditional probability (PDF) of returning to benefit in each interval. For each client off-benefit spell, randomly select a return to benefit interval using the probability distribution.

Calculating the total time on benefit

At this stage, for each client-interval spell we have up to three events. The first is the interval they exit main benefit (if not censored) and, if they exit, the interval they return to benefit (if not censored). Table 23 shows stylised examples of two clients whose outcomes are observed over eight intervals. Client A has an observed main benefit spell that lasts until interval 2. From intervals 3 to 4 they remain off main benefit, returning in interval 5. For the purposes of this analysis, we assume they remain on benefit until the censor interval. The modelled spell represents the estimated duration on benefit and subsequent duration off benefit. In this case, the client is estimated to remain on benefit until interval 3, remaining off benefit until interval 6, before returning to benefit from interval 7 onward.

Table 23: Example of observed, simulated modelled and counterfactual spells

		Interval								
		0	1	2	3	4	5	6	7	8
Client A	Actual	O	O	O			A	A	A	A
	Modelled	S	S	S	S				A	A
	Counterfactual	S	S				A	A	A	A
Client B	Actual	O	O	O	O	O	O	O	O	O
	Modelled	S	S	S						
	Counterfactual	S	S	S	S	S	S	S	S	S

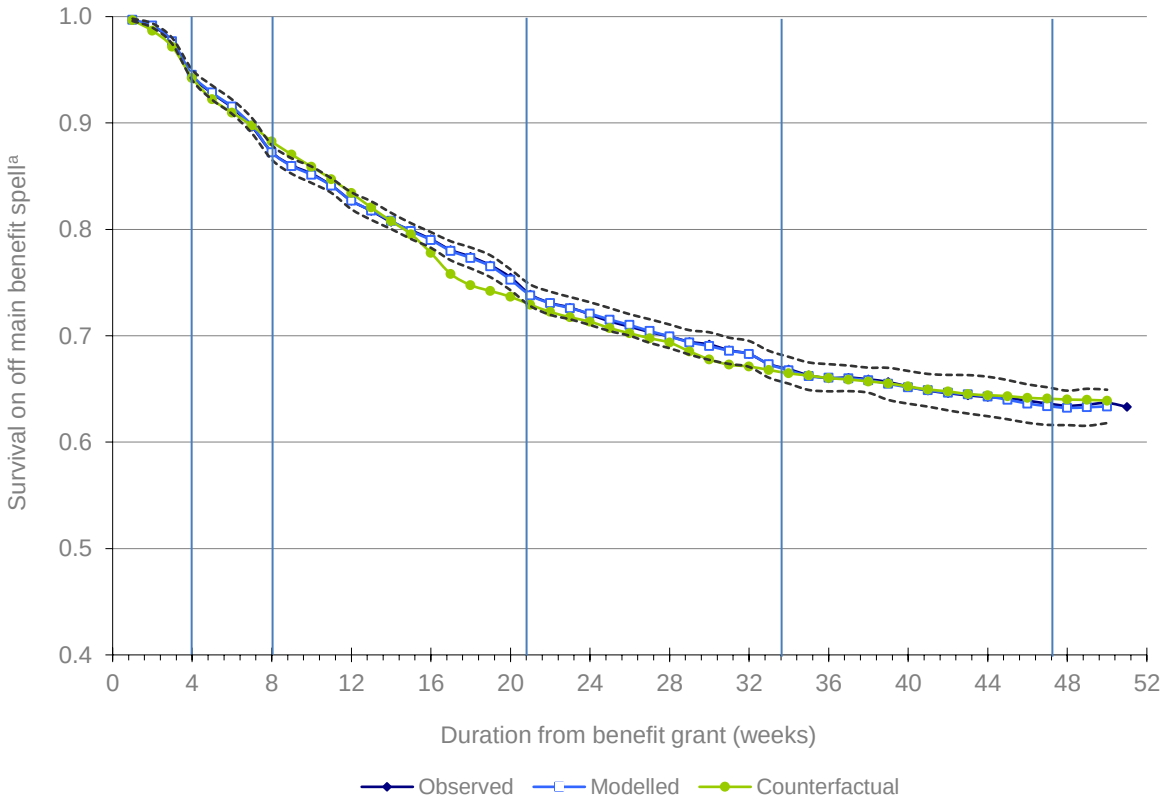
O: observed, S: simulated, A: assumed

For each iteration of the simulation, we can aggregate these individual results to calculate what the probability would be on main benefit in each interval. Table 23 shows the results for the three states (observed, modelled and counterfactual). These values are the proportion on benefit in each interval divided by the number of observations in the interval (eg uncensored spells).

Covariance of parameters between models

The reader might be wondering about the covariance in parameter estimates between the models. In other words, how is the parameter space in the duration on main benefit model linked to the parameter space of the duration off-benefit model? Because the information used to estimate each of the models was independent, the beta estimates for each model are also independent.

Figure 22: Probability of being on main benefit based on observed, modelled and counterfactual spells on and off main benefit



a: These are not survival curves, since they account for clients returning to main benefit after exit.
The dotted lines indicate the 95 percent confidence interval.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

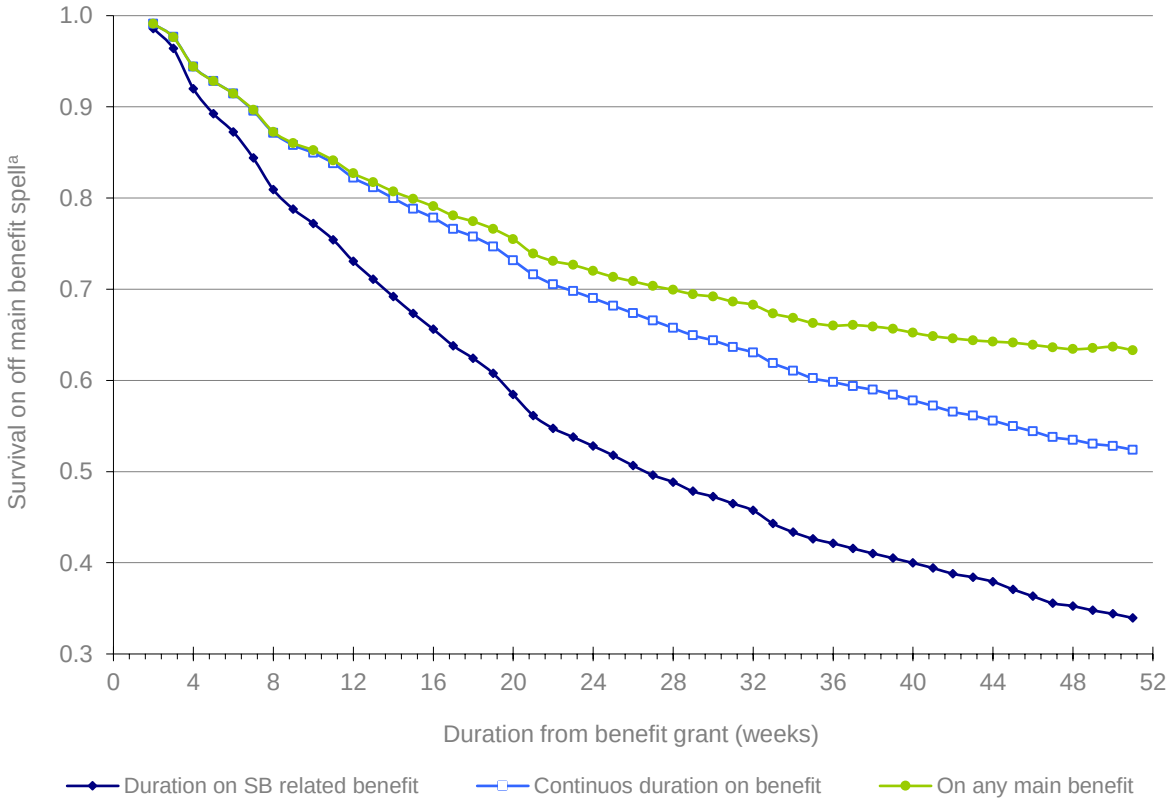
Active on main benefit is not the same as survival on initial main benefit spell

As stated previously, it is important to remember the probabilities in Figure 22 are not survival probabilities. To illustrate the difference, Figure 23 plots the survival on initial SB and main benefit spell and the probability of being on main benefit in each interval. Both are derived from the actual benefit spells for clients participating in the reapplication process. What is apparent from Figure 23 is that looking only at survival on main benefit tends to give the impression that clients move off benefit relatively quickly. The active on benefit shows the reduction to be much more modest. The difference between the proportion active on benefit and those still on their initial main benefit represents the clients who exited main benefit and subsequently returned to benefit.

However, while the survival on initial main benefit spell underestimates the probability of being on benefit in each interval, our current measure of active on main benefit overstates it. The reason is that we assume that if a client returns to main benefit they remain on for the remainder of the observed period (ie to the censor interval). Our assumption is the reapplication process has no impact on the time clients spend on subsequent spells on benefit.

Over longer outcome periods, this overestimation of the probability of being active on benefit will increase, but it will not have an influence on our estimated impact of the reapplication process.

Figure 23: Survival on SB and main benefit spell and probability of being active on main benefit



a: Active on main benefit is not survival curve, since it accounts for clients returning to main benefit after exit.

Source: Information Analysis Platform (BDD), CSRE, MSD (research data not official MSD statistics).

References

Allison, P. (1982). Discrete-time methods for the analysis of event histories. *Sociological Methodology, 13*, 61-98.

Dalgety, J., Dorsett, R., Johnston, S., & Spier, P. (2010). *Employment incentives for sole parents: Labour market effects of changes to financial incentives and support: Technical report*. Wellington: Ministry of Social Development and Inland Revenue.

Gentle, J. E. (2003). *Random number generation and Monte Carlo methods* (Second ed.). Berlin: Springer-Verlag.

Kittle, P. E., Richardson, D. S., & Parker, J. W. (1981). Two child abuse/child neglect examinations for the dentist. *ASDC Journal of Dentistry for Children, 48*(3), 175-180.

Liang, K., & Zeger, S. (1986). Longitudinal data analysis using generalized linear models. *Biometrika, 73*(1), 13-22.