

Investigation of provisional status of the NZIPS serious non-fatal self-harm and assault indicators

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21 December 2009

ISBN: 0-908958-79-X

OR 083

Suggested citation

Gulliver P, Cryer C, Davie G. Investigation of provisional status of the NZIPS serious non-fatal assault and self harm indicators. Injury Prevention Research Unit (University of Otago) OR083. December 2009.

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Acknowledgements

This project was funded by ACC Wellington, New Zealand and the Statistics New Zealand Injury Information Manager. Views and/or conclusions in this article are those of the Injury Prevention Research Unit and may not reflect the position of ACC or Statistics New Zealand. The data was sourced from the Ministry of Health's National Minimum Data Set. Thanks to John Langley and Conal Smith for providing feedback on an earlier version of this report.

Executive summary

In 2004, the Injury Prevention Research Unit (IPRU) at the University of Otago developed a set of fatal and serious non-fatal indicators to monitor the implementation of the New Zealand Injury Prevention Strategy (NZIPS)¹. In the 2004 Report, concerns were expressed about the validity of the serious non-fatal indicators of injury incidence for assault and self-harm. IPRU recommended that these serious non-fatal indicators be designated provisional to recognise concerns regarding their validity.

Changing social norms may make it more likely (for example) for a person who attends an emergency department for a true self-harm event having a mental health disorder detected and being admitted to hospital for treatment of the disorder. Circumstances such as this could result in an increased proportion of serious non-fatal self-harm cases with a principal diagnosis of mental health disorder rather than a principal diagnosis of injury. Given that the case definition of injury for the NZIPS indicators requires a principal diagnosis of injury, changes to the principal diagnosis for self-harm cases (from injury to mental health disorder) would impact on the trends reported in the Chartbooks.

Assault may also be subject to shifting levels of reporting. For example, it is possible that recent health promotion campaigns to reduce domestic violence may have increased the acceptability of reporting such events to hospital in-patient staff. This influence would be independent of principal diagnosis (as these recorded cases would continue to have an injury diagnosis), but would impact on the trends reported in the Chartbooks² as there would be an increased proportion of true cases of assault with a specific injury diagnosis that had an associated (recorded) assault external cause of injury code³. Empirical evidence is required to determine if variable levels of reporting do exist.

We are unaware of any research that has investigated the possibility of variable levels of reporting for recorded assault (given a true assault case presents) or recorded self-harm injury (given a true self-harm presents), over time, as a result of changing social norms.

¹ Cryer, C. Langley, J. Stephenson, S. (2004) Developing valid injury outcome indicators: A report for the New Zealand Injury Prevention Strategy. Injury Prevention Research Unit, University of Otago, Dunedin. OR 049.

² The 'Chartbooks' present trends in fatal and serious non-fatal injury as a method of measuring the impact of the New Zealand Injury Prevention Strategy. They are publicly available, annually up-dated and are produced for the New Zealand population as a whole, Māori and children aged 0-14 years (see <http://www.nzips.govt.nz/resources/publications.php> for the latest versions).

³ Unless it is mentioned in the text that "true" or "reported/recorded" cases are being described, it should be assumed that the description is of a "reported/recorded" case.

Aims

We sought to answer whether, given a true self-harm, or true assault case presenting at, and being admitted to, hospital with a high risk diagnosis, has the likelihood of reporting a self-harm or assault event changed over time? To answer this question, we tested the following hypotheses:

- a. Given that a real case of self-harm had occurred resulting in serious non-fatal injury, that there had been an increase in the reporting of serious non-fatal self-harm related injuries.
- b. That there had been an increased likelihood of serious non-fatal self-harm cases being recorded with a principal diagnosis of a mental health disorder.
- c. Given that a serious non-fatal assault related injury had occurred, that there had been an increase in the reporting of serious non-fatal assault related injuries.

Self-harm

To justify removal of the provisional status of the self-harm indicator, we sought to identify consistent reporting of self-harm events in a ‘high risk’ group of hospital patients selected from the NMDS. We identified diagnoses which could be considered sentinel diagnoses for self-harm events, and investigated these as well as the complete mental health chapter. To be considered as a sentinel diagnosis, the following criteria had to be fulfilled:

- i) Identified frequently as a principal or contributing diagnosis for serious non-fatal self-harm events;
- ii) Had a high proportion of cases with the relevant code in the principal or contributing diagnosis that were self-harm events.

Five diagnoses were subsequently identified:

- F322: Severe depressive episode without psychotic symptoms;
- F329: Depressive episode, unspecified;
- F431: Post-traumatic stress disorder;
- F432: Adjustment disorders;
- F6021: Dissocial personality disorder

The following process was then undertaken.

- (a) From the NMDS, all serious non-fatal hospitalizations were identified and classified into one of the following groups:

Set name	Description
Set A	Principal diagnosis in the range F00-F99 Contributing diagnosis in the range S00-T78
Set A sent	Principal diagnosis one of the sentinel diagnoses Contributing diagnosis in the range S00-T78
Set B	Principal diagnosis in the range S00-T78 Contributing diagnosis in the range F00-F99
Set B sent	Principal diagnosis in the range S00-T78 Contributing diagnosis one of the sentinel diagnoses

Only first admissions for an injury event were included in this investigation.

(b) Separately for Set A and Set B (and “Set A sent” and “Set B sent”), the proportion assigned a self-harm external cause of injury code were calculated for each year from 2001-2007.

To determine whether the reporting of mental health conditions associated with reported self-harm has changed over time, all cases in the NMDS with a principal diagnosis of injury or mental health disorder, and an external cause of injury code of self-harm were identified. From this group the proportion with a principal diagnosis of injury and a contributing diagnosis of mental health disorder, and the proportion of self-harm cases with a principal diagnosis of mental health disorder and a contributing diagnosis of injury over time were determined. This analysis was conducted to determine if there had been a systematic change in the way self-harm events were recorded – as injury events or as mental health events.

Results

Set A and B, and “Set A sent” and “Set B sent”, combined

When Set A and B were combined, a significant difference in the proportions of cases with a self-harm external cause code was identified over the years 2001 - 2007 (chi 2 (6df) = 21.2, p=0.002) (Table i). No significant linear trends were identified between 2001 and 2007 (chi 2 (1df) = 0.06, p = 0.8).

When “Set A sent” and “Set B sent” were combined, there was no significant difference in the proportions of cases with a self-harm external cause code identified over the years 2001 - 2007 (chi 2 (6df) = 7.2, p=0.3) (Table i). No significant linear trends were identified between 2001 and 2007 (chi 2 (1df) = 2.0, p = 0.2). These results are consistent with those identified for Set A and Set B separately.

Table i. Proportion of serious non-fatal ‘self-harm’ cases with a principal diagnosis of mental health disorder or injury and contributing diagnosis of the converse; frequency and % (Set A + Set B, Set A sent and Set B sent)

Self-harm	Discharge year						
	2001	2002	2003	2004	2005	2006	2007
	Frequency and % with a self-harm external cause code						
Set A and B Total (n)	1611	1643	1668	1718	1789	1931	1928
Self-harm (n)	167	148	197	211	158	180	210
% Self-harm	10	9	12	12	9	9	11
Set A sent and Set B sent Total (n)	160	148	155	151	121	127	142
Self-harm (n)	79	78	92	95	69	72	81
% Self-harm	49	53	59	63	57	57	57

There was no significant difference between years in the proportion of serious non-fatal self-harm cases with a principal diagnosis of injury and contributing diagnosis of mental health

disorder ($\chi^2 (6 \text{ df}) = 7.1, p = 0.3$). In addition, there was no linear change in the proportion of serious non-fatal cases with a principal diagnosis of injury and contributing diagnosis of mental health disorder ($\chi^2 (1 \text{ df}) = 0.06, p = 0.8$).

There was a significant difference between years in the proportion of serious non-fatal self-harm cases with a principal diagnosis of mental health disorder and contributing diagnosis of injury ($\chi^2 (6 \text{ df}) = 38.9, p < 0.001$). There was no linear change in the proportion of serious non-fatal cases with a principal diagnosis of mental health disorder and contributing diagnosis of injury ($\chi^2 (1 \text{ df}) = 0.6, p = 0.4$).

Table ii: Serious non-fatal self-harm cases: distribution of principal and contributing diagnoses over time

Principal diagnosis	Discharge year						
	2001	2002	2003	2004	2005	2006	2007
Injury	103	84	92	119	97	119	122
%	51	43	41	45	47	49	43
Mental health	20	16	48	53	27	17	33
%	10	8	21	20	13	7	12
Non-injury non-mental health	80	96	86	90	82	106	128
%	39	49	38	34	40	44	45
Total	203	196	226	262	206	242	283

Conclusion

There has been no detectable systematic change over time in the recording of serious non-fatal self-harm cases between 2001 and 2007. As such, we recommend that the provisional status for the serious non-fatal self-harm indicator should be removed. From 2010, we recommend that the chart for the serious non-fatal self-harm indicator should be produced for a time series beginning with 2001. We also recommend that this analysis should be repeated at regular intervals (eg. every two years) to ensure that there are no systematic changes in the way serious non-fatal self-harm cases are recorded in the NMDS in the future.

Assault

We identified sentinel diagnosis for assault that satisfied two criteria:

- a) Those diagnoses that most frequently occurred amongst cases coded to assault.
- b) From these diagnoses, those which have a high proportion of assault as the external code.

This resulted in the identification of just two diagnoses: S023 (Fracture of orbital floor) and S0260 (fracture of the mandible, part unspecified).

Although we intended to produce sentinel diagnoses for males and females separately, insufficient numbers of serious non-fatal assault cases for female precluded this. Therefore, in order to provide some insight into the variability of the assault indicator for other hospital discharges for groups with relatively small numbers of assaults resulting in serious injury (such as females and young children), we also conducted the analysis using all of the diagnoses identified as occurring most frequently in the age-sex breakdowns amongst cases coded to assault and for which there was a high proportion with an assault external cause code (herein referred to as 'high frequency diagnoses').

For each sentinel diagnosis (S0260 and S023), and for the group of high frequency diagnoses, we investigated the proportion coded to assault for serious non-fatal hospital admissions since 2001.

Results

Table iii presents the proportion of assault cases for the population of serious non-fatal hospitalizations with either of the sentinel diagnoses between 2001 and 2007. There was no significant difference between years in the proportions ($\chi^2(6df) = 2.8, p=0.8$), nor was there any detectable linear trend over time ($\chi^2(1df) = 0.76, p=0.4$).

Table iii: Serious non-fatal cases with a principal diagnosis of 'S024' or 'S0206'

Assault external cause code	Year of discharge						
	2001	2002	2003	2004	2005	2006	2007
No	50	43	42	57	76	82	63
%	41	36	35	41	40	43	41
Yes	71	77	77	82	114	110	90
%	59	63	65	59	60	57	59
Total	121	120	119	139	190	192	153

The proportion of assault cases for the population of serious non-fatal hospitalizations with any of the high frequency diagnoses is presented in Table iv. Again, there was no difference between the years in the proportions with an assault external cause code ($\chi^2(7df) = 11.71, p=0.1$), nor was there any significant linear trend across the years identified ($\chi^2(1df) = 0.1, p=0.7$).

Table iv: Serious non-fatal assault cases with ‘high frequency’ diagnoses^a

High frequency diagnosis	Year of discharge						
	2001	2002	2003	2004	2005	2006	2007
No	461	483	451	462	539	605	616
%	68	70	70	64	67	66	68
Yes	214	203	195	260	269	310	306
%	32	30	30	36	33	34	32
Total	675	686	646	722	808	915	915

^a ‘High frequency’ diagnoses were:
‘S0085’ Superficial injury of other parts of head
‘S010’ Open wound of scalp
‘S022’ Fracture of nasal bones
‘S023’ Fracture of orbital floor
‘S024’ Fracture of malar and maxillary bones
‘S0260’ Fracture of the mandible, part unspecified
‘S028’ Fracture of other skull and facial bones
‘S065’ Traumatic subdural haemorrhage

Conclusion

There has been no systematic change in the recording of assault cases resulting in serious non-fatal injury between 2001 and 2007. As such, we recommend that the provisional status for the serious non-fatal assault indicator should be removed. From 2010, we recommend that the serious non-fatal assault chart should be produced for the time series beginning 2001. We also recommend that this analysis should be repeated at regular intervals (eg. every two years) to ensure that there are no systematic changes in the way serious non-fatal assault cases are recorded in the NMDS in the future.

Background

In 2004, the Injury Prevention Research Unit (IPRU) at the University of Otago developed a set of fatal and serious non-fatal indicators to monitor the implementation of the New Zealand Injury Prevention Strategy (NZIPS)⁴. In the 2004 Report, concerns were expressed about the validity of the serious non-fatal indicators of injury incidence for assault and self-harm. IPRU recommended that these serious non-fatal indicators be designated provisional to recognise concerns regarding their validity.

Fatal cases of assault or self-harm are subjected to a rigorous investigation by the Police, pathologists and/or coroners in order to attribute cause and intent. The National Minimum Data Set of hospital discharge data (NMDS), on which the serious non-fatal assault and self-harm indicators are based, are not subjected to the same level of investigation as fatal cases. The NMDS relies on either the level of disclosure of the patient or the astuteness of the hospital clinicians to determine intent and, as such, the serious non-fatal assault and self-harm indicators may be prone to fluctuations in reporting due to, for example, changing social norms.

The current case selection criteria for serious non-fatal self-harm and assault injury events from the NMDS is that they have an International Classification of Diseases (ICD) diagnosis code in the range S00-T78 and a first listed external cause code in the range X60-X84 (self-harm) or X85-Y09 (assault). In addition, the ICD based injury severity score (ICISS) for the event must be less than or equal to 0.941.⁵ This corresponds with a threat to life of 5.9% or greater.

Changing social norms may result (for example) in a person who attends an emergency department for a true self-harm event being more likely to have a mental health disorder detected and subsequently being admitted to hospital for treatment of the disorder. Scenarios such as this could result in an increased proportion of serious non-fatal self-harm cases with a principal diagnosis of mental health disorder rather than a principal diagnosis of injury. Given that the case definition of injury for the NZIPS indicators requires a principal diagnosis of injury, changes to the proportion with a principal diagnosis for self-harm cases (from injury to mental health disorder) would impact on the trends reported in the Chartbooks.

⁴ Cryer, C. Langley, J. Stephenson, S. (2004) Developing valid injury outcome indicators: A report for the New Zealand Injury Prevention Strategy. Injury Prevention Research Unit, University of Otago, Dunedin. OR 049.

⁵ For the purposes of the Serious Injury Outcome Indicator Chartbooks, serious is defined in terms of threat to life, in accordance with the methods outlined by Cryer et al (2004). Those with an ICISS score of 0.941 or less, (a change of dying of at least 5.9%) are considered serious.

Assault may also be subject to shifting levels of reporting. For example, it is possible that recent health promotion campaigns to reduce domestic violence may have increased the acceptability of reporting such events to hospital in-patient staff. Cases such as this will have, in addition to their principal diagnoses of injury, an associated assault external cause of injury code. This could lead to an increased proportion of reported true cases of assault resulting in serious injury that will obviously impact on the trends in the Chartbooks.^{6, 7} Empirical evidence is required to determine if variable levels of reporting do exist. We are unaware of any research that has investigated the possibility of variable levels of reporting for recorded assault (given a true assault case presents) or recorded self-harm injury (given a true self-harm presents), over time, as a result of changing social norms.

We sought to answer whether, given a true self-harm, or true assault case presenting at, and being admitted to, hospital with a high risk diagnosis, has the likelihood of reporting a self-harm or assault event changed over time? To answer this question, we tested the following hypotheses:

- a. Given that a real case of self-harm had occurred resulting in serious non-fatal injury, that there had been an increase in the reporting of serious non-fatal self-harm related injuries.
- b. That there had been an increased likelihood of serious non-fatal self-harm cases being recorded with a principal diagnosis of a mental health disorder.
- c. Given that a serious non-fatal assault related injury had occurred, that there had been an increase in the reporting of serious non-fatal assault related injuries.

For clarity, this report has been divided into two sections. The first section presents the methods, results and discussion for the evaluation of the serious non-fatal self-harm indicator, the second section provides the methods, results and discussion for the evaluation of the serious non-fatal assault indicator.

⁶ The 'Chartbooks' present trends in fatal and serious non-fatal injury as a method of measuring the impact of the New Zealand Injury Prevention Strategy. They are publicly available, annually up-dated and are produced for the New Zealand population as a whole, Māori and children aged 0-14 years (see <http://www.nzips.govt.nz/resources/publications.php> for the latest versions).

⁷ Unless it is mentioned in the text that "true" or "reported/recorded" cases are being described, it should be assumed that the description is of a "reported/recorded" case.

Section 1

Evaluation of the serious non-fatal self-harm indicator

Methods

1. Principal diagnosis of mental health disorder or of injury: % self-harm over time

Depression is a major risk factor for self-harm. Current estimates suggest that 50% of self-harm cases have a previous diagnosis of depression, while another 40% have another mental health diagnosis⁸. Therefore, it was our intent to use injury with ‘depression’ as a marker for possible self-harm cases. Depression was defined according to the International Classifications of Injury and Diseases Australian Modification, 10th revision (ICD-10-AM) diagnosis codes (F32-F34).

To justify removal of the provisional status of the self-harm indicator, we sought to identify consistent reporting of self-harm events in a ‘high risk’ group of hospital patients selected from the NMDS. As serious injury with depression was considered a marker for self-harm then, if:

- (a) reporting of depression was stable amongst cases with both a serious injury and a mental health condition, and
- (b) rates of reporting self-harm amongst those recorded with both injury and depression diagnoses were stable (no systematic trend over time),

then the percent of true self-harm cases that report self-harm should also be stable over time.

We assumed that those with depression have increased risk of self-harm (see *Background* section above). Those who are admitted to hospital with a self-harm event could have a principal diagnosis of depression rather than the injury. We planned, therefore, in the first instance, to investigate the pattern of recorded principal diagnosis amongst those with both an injury and depression diagnosis on the NMDS record.

Whether injury was the recorded PDx, or depression was the recorded PDx, to investigate whether the recording of self-harm was stable over time, we planned to consider the yearly proportion of those with both an injury and depression diagnosis that had a recorded self-harm external cause. If there was stable reporting of depression this would provide evidence of stability of reporting of self-harm.

The above describes our proposal, prior to study start. Taking the first of these, ie. “(a) the consistency in the way mental health disorders, in particular depression, were recorded in the NMDS over time”, preliminary analysis of the data provided evidence that there was not stability of reporting of depression for older adults (aged over 60 years, Table 1). The number of serious non-fatal self-harm hospitalisations with a principal diagnosis in the range S00-T78 and a contributing diagnosis in the range F32-F34 ranged from 59 in 2001 to 29 in 2007.

⁸ Isacsson, G. Rich, C.L. (2001) Regular review: Management of patients who deliberately self-harm themselves. *British Medical Journal* 322: 213-215

Table 1: Frequency of self-harm external cause of injury codes for serious non-fatal hospitalisations with a principal diagnosis in the range S00-T78^a and a contributing diagnosis in the range F32-F34^b

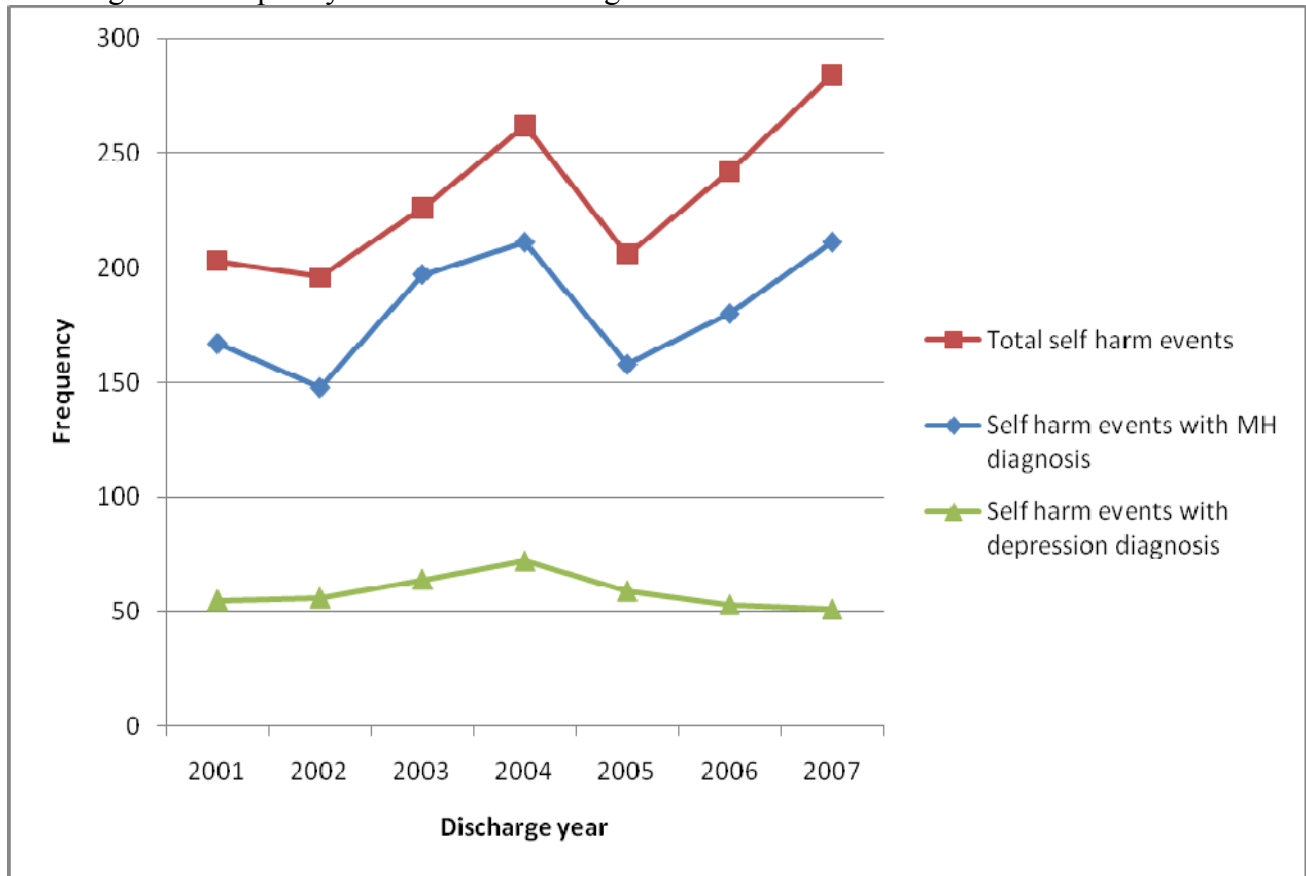
Age	Year of Discharge						
	2001	2002	2003	2004	2005	2006	2007
< 60 years	61	63	61	65	68	66	61
≥ 60 years	59	45	32	36	28	30	29
Total	120	108	93	101	96	96	87

^a The ICD-10-AM diagnosis code range S00-T78 represents injury related diagnoses

^b The ICD-10-AM diagnosis code range F32-F34 represents depression diagnoses

Further investigation of this revealed that there was a decreasing proportion of serious non-fatal self-harm events with a depression diagnosis, and that this was not a good marker for serious non-fatal self-harm events over time. Figure 1 shows, for recorded serious non-fatal self-harm events, the (a) frequency of recording of total events between 2001 and 2007; (b) the frequency of events with a mental health diagnosis (principal or contributing) between 2001 and 2007; and (c) the frequency of events with a depression diagnosis (principal or contributing) between 2001 and 2007. It is apparent that the frequency of self-harm events with any mental health disorder reflects the trends in the frequency of total self-harm events, suggesting stability of reporting of mental health disorders amongst recorded self-harm cases over time. In contrast, the frequency of self-harm events with a depression diagnosis displays a flatter pattern. Because of the variations identified, we shifted our focus from using a marker “depression” to the marker “all mental health disorders”.

Figure 1: Frequency of mental health diagnoses for serious non-fatal self-harm events.



However, as can be seen from Figure 2 below, when all mental health disorders are investigated, rather than just depression, serious non-fatal self-harm events were dominated by cases with an 'F1' diagnosis ('Mental and behavioural disorders due to psychoactive substance use'). Only 10% of such cases are associated with a self-harm event, leaving these diagnoses exposed to the effects of extraneous factors, should they be used as 'marker' diagnoses for self-harm events.

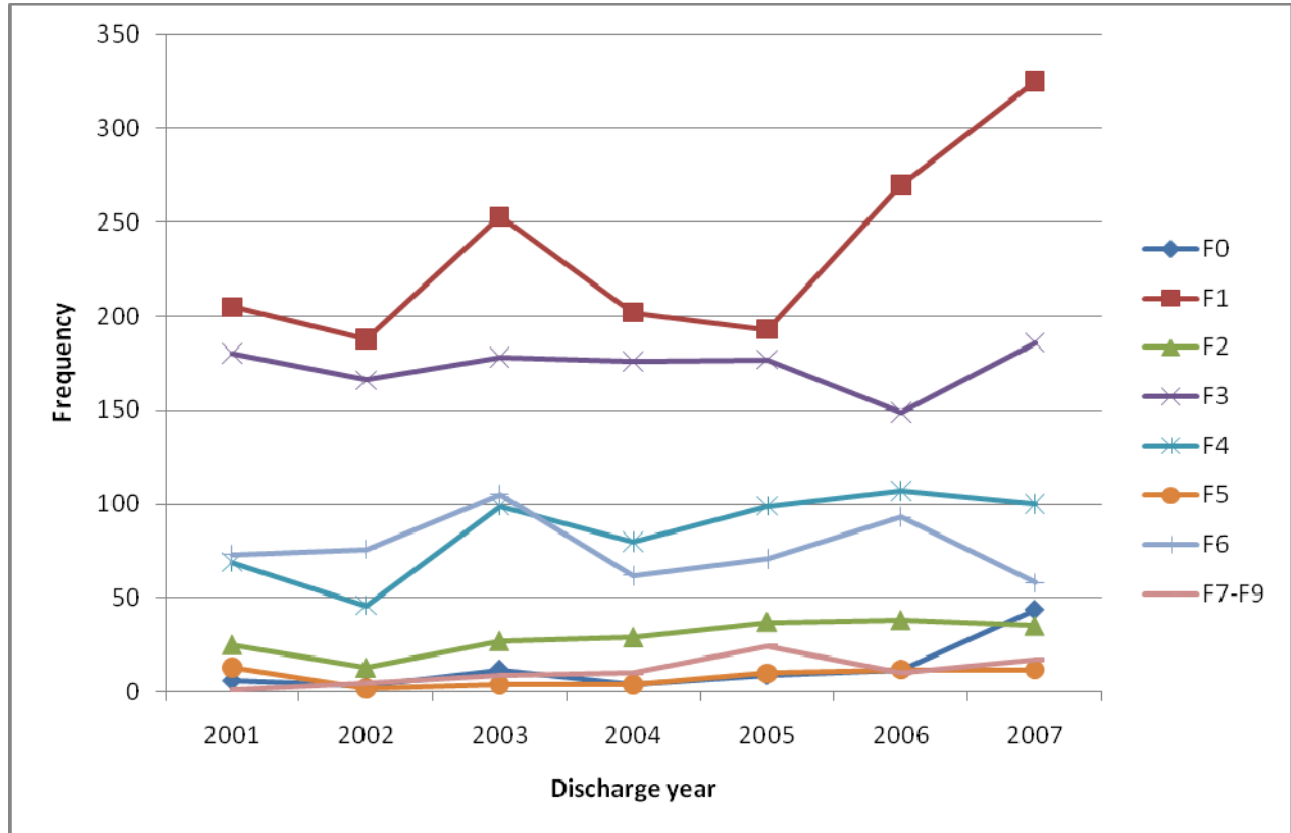
As such, we sought to determine other diagnoses which could be considered sentinel diagnoses for self-harm events, and investigated these also. To be considered as a sentinel diagnosis, the following criteria had to be fulfilled:

- i) Identified frequently as a principal or contributing diagnosis for serious non-fatal self-harm events;
- ii) Had a high proportion of cases with the relevant code in the principal or contributing diagnosis that were self-harm events.

Five diagnoses were subsequently identified:

- F322: Severe depressive episode without psychotic symptoms;
- F329: Depressive episode, unspecified;
- F431: Post-traumatic stress disorder;
- F432: Adjustment disorders;
- F6021: Dissocial personality disorder

Figure 2: Frequency of contributing diagnoses for recorded serious non-fatal self-harm events*.



*Note: Each event may have more than one contributing diagnosis. As such the frequencies presented are larger than the number of self-harm events.

Key:

- F0 = Organic, including symptomatic, mental disorders
- F1 = Mental and behavioural disorders due to psychoactive substance abuse
- F2 = Schizophrenia, schizotypal and delusional disorders
- F3 = Mood {affective} disorders
- F4 = Neurotic, stress related and somatoform disorders
- F5 = Behavioural syndromes associated with physiological disturbances and physical factors
- F6 = Disorders of adult personality and behavior
- F7 = Mental retardation
- F8 = Disorders of psychological development
- F9 = Behavioural and emotional disorders with onset usually occurring in childhood and adolescence

As a result of this exploratory analysis, the following process was undertaken.

- (a) From the NMDS, all serious non-fatal hospitalizations were identified and classified into the following groups:

Set name	Description
Set A	Principal diagnosis in the range F00-F99 (Mental health condition) Contributing diagnosis in the range S00-T78 (Injury)
Set A sent	Principal diagnosis one of the sentinel diagnoses Contributing diagnosis in the range S00-T78
Set B	Principal diagnosis in the range S00-T78 Contributing diagnosis in the range F00-F99
Set B sent	Principal diagnosis in the range S00-T78 Contributing diagnosis one of the sentinel diagnoses

Only first admissions for an injury event were included in this investigation.

- (b) Separately for Set A and Set B (and “Set A sent” and “Set B sent”), the proportion assigned a self-harm external cause of injury code were calculated for each year from 2001-2007.

Statistical Analysis

The hypotheses of no change in the proportion assigned a self-harm external cause code was tested using chi-squared tests and nonparametric tests for trend from 2001 to 2007. The non-parametric tests for trend provided an approximately equivalent test to the chi-squared 1-degree of freedom test for trend. Differences were investigated separately for Set A and Set B, and Set A and B combined (and Set A sent and Set B sent).

2) For incident events coded to self-harm, % principal diagnosis of injury or % principal diagnosis of mental health disorder over time.

To determine whether the reporting of mental health conditions associated with reported self-harm has changed over time, all cases in the NMDS with a principal diagnosis of injury or mental health disorder, and an external cause of injury code of self-harm were identified. From this group the proportion with a principal diagnosis of injury and a contributing diagnosis of mental health disorder, and the proportion of self-harm cases with a principal diagnosis of mental health disorder and a contributing diagnosis of injury over time were determined. This analysis was conducted to determine if there had been a systematic change in the way self-harm events were recorded – as injury events or as mental health events. The following process was used.

- (a) All incident events with an external cause of injury code of self-harm were identified from the NMDS.
- (b) For incident serious non-fatal cases coded to self-harm, the proportions of incident events with a principal diagnosis of injury (S00-T78) and a contributing diagnosis of mental health disorder (F00-F99) for each year between 2001 and 2007 were calculated.
- (c) In addition, for those serious non-fatal incident cases coded to self-harm, the proportions of incident events with a principal diagnosis of mental health disorder (F00-F99) and a contributing diagnosis of injury (S00-T78) for each year between 2001 and 2007 were calculated.
- (d) As described above, chi-squared tests, and nonparametric tests for trend were used to test the hypothesis of no change in the proportion of incident events coded to self-harm assigned a principal diagnosis of injury or mental and behavioural disorder over time.
- (e) The patterns of self-harm differ between men and women. There are also potentially different mitigating and/or protective factors. As such, it is possible that changes in identification and treatment of self-harm may vary between the genders. To determine if there was any effect of gender, differences for serious non-fatal discharges were also investigated for males and females separately.

Results

1) *Principal diagnosis of mental health disorder or of injury: % self-harm over time*

Set A and “Set A sent”

For the period 2001-2007, there were 558 serious non-fatal injury cases recorded in the NMDS with a principal diagnosis of mental health disorder and a contributing diagnosis of injury (Set A). The proportion of these cases with a self-harm external cause of injury code ranged from 23-54% (Table 2). Although there was a significant difference in the proportions of cases with a self-harm external cause code ($\chi^2 (6df) = 34.3, p < 0.001$), there was no significant linear trend between 2001 and 2007 ($\chi^2 (1df) = 0.17, p = 0.7$).

For the period 2001-2007, there were 63 serious non-fatal cases recorded in the NMDS with one of the sentinel mental health diagnoses and a contributing diagnosis of injury (Set A sent). The proportion of these cases with a self-harm external cause of injury code ranged from 80-100% (Table 2). There were no significant differences in the proportions of cases with a self-harm external cause code ($\chi^2 (6df) = 1.8, p = 0.9$), and there was no significant linear trend between 2001 and 2007 ($\chi^2 (1df) = 0.03, p = 0.9$).

Table 2: Serious non-fatal cases with a principal diagnosis of mental health disorder and contributing diagnosis of injury: Frequency and percent self-harm (Set A and Set A sent)

Self-harm	Discharge year						
	2001	2002	2003	2004	2005	2006	2007
	Frequency and % with a self-harm external cause code						
Set A Total (n)	74	65	91	99	71	74	85
Self-harm (n)	20	16	48	53	27	17	33
% <i>Self-harm</i>	27	25	53	54	38	23	39
Set A sent Total(n)	11	10	18	14	2	2	6
Self-harm (n)	10	8	16	13	2	2	5
% <i>Self-harm</i>	90	80	80	93	100	100	93

Set B and “Set B sent”

There were 11,730 serious non-fatal injury cases with a principal diagnosis of injury and a contributing diagnosis of mental health disorder between 2001 and 2007. There was no significant difference in the proportion of set B with a self-harm external cause code between 2001 and 2007 (chi 2 (6df) = 7.8, p=0.3, Table 3), and no significant linear trend across the years investigated (chi 2 (1df) = 0.04, p = 0.9).

There were 941 serious non-fatal cases with a principal diagnosis of injury and a contributing diagnosis of one of the sentinel mental health diagnoses between 2001 and 2007 (Set B sent). There was no significant difference in the proportion of set B sent with a self-harm external cause code between 2001 and 2007 (chi 2 (6df) = 6.8, p=0.3, Table 3), and no significant linear trend across the years investigated (chi 2 (1df) = 3.4, p = 0.07).

Table 3 Serious non-fatal cases with a principal diagnosis of injury and contributing diagnosis of mental health disorder: Frequency and percent self-harm (Set B and Set B sent)

Self-harm	Discharge year						
	2001	2002	2003	2004	2005	2006	2007
	Frequency and % with a self-harm external cause code						
Set B Total (n)	1537	1578	1577	1619	1718	1857	1843
Self-harm (n)	147	132	149	158	131	163	177
% <i>Self-harm</i>	10	8	9	10	8	9	10
Set B sent Total (n)	149	138	137	137	119	125	136
Self-harm (n)	69	70	76	82	67	70	76
% <i>Self-harm</i>	46	51	56	60	56	56	56

Set A and B, and “Set A sent” and “Set B sent”, combined

When set A and B were combined, a significant difference in the proportions of cases with a self-harm external cause code was identified over the years 2001 - 2007 (chi 2 (6df) = 21.2, p=0.002) (Table 4). No significant linear trends were identified between 2001 and 2007 (chi 2 (1df) = 0.06, p = 0.8).

When set A and B sent were combined, there was no significant difference in the proportions of cases with a self-harm external cause code identified over the years 2001 - 2007 (chi 2 (6df) = 7.2, p=0.3) (Table 4). No significant linear trends were identified between 2001 and 2007 (chi 2 (1df) = 2.0, p = 0.2).

Table 4 Proportion of serious non-fatal ‘self-harm’ cases with a principal diagnosis of mental health disorder or injury and contributing diagnosis of the converse; frequency and % (Set A + Set B, Set A sent and Set B sent)

Self-harm	Discharge year						
	2001	2002	2003	2004	2005	2006	2007
	Frequency and % with a self-harm external cause code						
Set A and B Total (n)	1611	1643	1668	1718	1789	1931	1928
Self-harm (n)	167	148	197	211	158	180	210
% <i>Self-harm</i>	10	9	12	12	9	9	11
Set A sent and Set B sent Total (n)	160	148	155	151	121	127	142
Self-harm (n)	79	78	92	95	69	72	81
% <i>Self-harm</i>	49	53	59	63	57	57	57

2) *Self-harm cases: % principal diagnosis of injury and contributing diagnosis of mental health disorder or % principal diagnosis of mental health disorder and contributing diagnosis of injury over time.*

For this aim, all serious non-fatal cases with an external cause of injury code of self-harm were identified from the NMDS. We calculated the proportion with:

- a) A principal diagnosis of mental health disorder (F00-F99) and contributing diagnosis of injury (S00-T78), or;
- b) A principal diagnosis of injury (S00-T78) and contributing diagnosis of mental health disorder (F00-F99), or;
- c) The remaining cases that did not satisfy either of the above conditions

There were 1618 incident cases of serious non-fatal self-harm recorded in the NMDS from 2001 to 2007 (Table 5). Of the incident non-fatal self-harm cases, 45% (n=736) had a principal diagnosis of injury and contributing diagnosis of mental health disorder, 13% (n=214) had a principal diagnosis of mental health disorder and contributing diagnosis of injury, and 41% (n=668) were ‘other’ combinations.

In the ‘other’ category, the majority had a principal diagnosis of injury as well as a contributing diagnosis of injury. A small number had a principal diagnosis of mental health disorder and a contributing diagnosis of mental health disorder or another principal diagnosis, including complications of trauma, medical and surgical care, and other sequelae of injuries.

There was no significant difference between years in the proportion of serious non-fatal self-harm cases with a principal diagnosis of injury and contributing diagnosis of mental health disorder (chi 2 (6 df) = 7.1, p = 0.3). In addition, there was no linear change in the proportion of serious non-fatal cases with a principal diagnosis of injury and contributing diagnosis of mental health disorder (chi 2 (1df) = 0.06, p = 0.8).

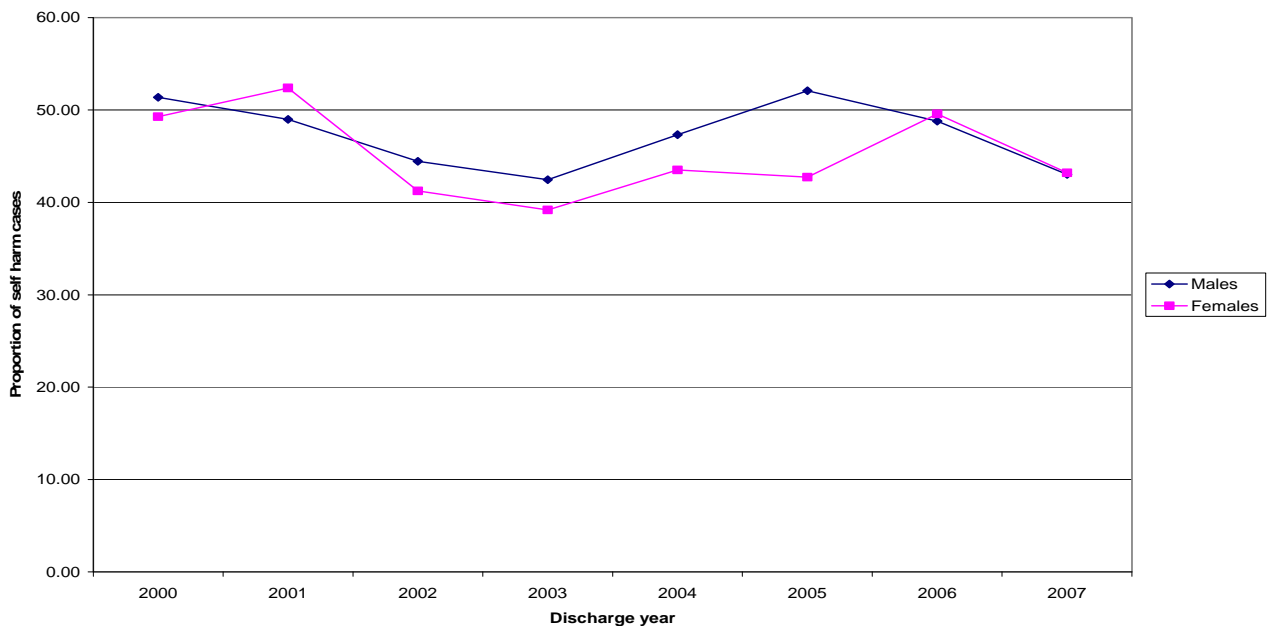
There were significant differences between years in the proportion of serious non-fatal self-harm cases with a principal diagnosis of mental health disorder and contributing diagnosis of injury (chi 2 (6 df) = 38.9, p < 0.001). There was no linear change in the proportion of serious non-fatal cases with a principal diagnosis of mental health disorder and contributing diagnosis of injury (chi 2 (1df) = 0.6, p = 0.4).

Table 5: Serious non-fatal self-harm cases: distribution of principal and contributing diagnoses over time

Principal diagnosis	Discharge year						
	2001	2002	2003	2004	2005	2006	2007
Injury	103	84	92	119	97	119	122
%	51	43	41	45	47	49	43
Mental health	20	16	48	53	27	17	33
%	10	8	21	20	13	7	12
Non-injury non-mental health	80	96	86	90	82	106	128
%	39	49	38	34	40	44	45
Total	203	196	226	262	206	242	283

To determine if there was any effect of gender on the patterns of principal diagnosis described above, analysis for serious non-fatal self-harm was repeated separately for each gender. Figure 3 shows the proportion of serious non-fatal self-harm cases with a principal diagnosis of injury and contributing diagnosis of mental health disorder over time for each gender. There was some evidence of difference between years in the proportion of cases with a principal diagnosis of injury and contributing diagnosis of mental health disorder for both genders (males, chi 2 (6 df) = 4.3, p = 0.07; females, chi 2 (6 df) = 6.5, p = 0.05), although no significant linear trends were identified (males, chi 2 (1df) = 0.5, p = 0.5; females, chi 2 (1df) = 0.4, p = 0.5). There were insufficient numbers to conduct this analysis for those cases with a principal diagnosis of mental health disorder and contributing diagnosis of injury.

Figure 3: Serious non-fatal self-harm cases, proportion with principal diagnosis of injury and contributing diagnosis of mental health disorder over time separately for gender.



We sought to investigate whether the small numbers presented for some of the analyses above masked trends in reporting that may be impacting on the frequencies of reported serious non-fatal self-harm injuries⁹. To do this we calculated a regression line with confidence intervals for each analysis. The upper confidence interval was considered the ‘worst case’ – the most extreme but plausible trend for changes in levels of recording. In Table 6, the trend in annual frequencies of serious non-fatal self-harm injuries between 2001 and 2007, for each of the above analyses, has been estimated using the upper confidence interval. This table shows the number of cases of reported serious non-fatal self-harm each year, if the likelihood of recording increased over time at the rate indicated by the upper 95% CI of the slope coefficient.

Table 6 shows that, compared with column 2 (the frequency of self-harm as recorded in the 2008 Chartbook), the regression lines only explained a small proportion of the variation between 2001 and 2007. The majority of the explored analyses explained between 3% and 36% of the observed increase in serious non-fatal self-harm frequency over time. “Set A Sent/ Set B Sent” combined (Sentinel principal or contributing diagnosis with associated injury diagnosis) explained 50% of the observed increase.

Table 6: Impact of identified trend on self-harm frequencies as recorded in 2001.

Year	Current frequency	Set A ¹	Set B ²	Set B sent ³	Set A and B ⁴	Set A and B sent ⁵	Set C (1) ⁶	Set C (2) ⁷
2001	177	177	177	177	177	177	177	177
2002	173	180	178	181	177	182	179	178
2003	167	184	179	184	178	187	181	178
2004	197	188	180	188	178	193	182	179
2005	170	192	181	192	178	198	184	179
2006	218	196	181	195	179	204	186	180
2007	245	201	182	199	179	211	188	180
Increase (2001-2007)	68	24	5	22	2	34	11	3
% change relative to Chartbook increase		35%	7%	32%	3%	50%	16%	4%

1. Regression slope = 0.0043, std error = 0.011, 95% CI -0.012, 0.021
2. Regression slope = -0.0025, std error = 0.0013, 95% CI -0.005, 0.005
3. Regression slope = 0.014, std error = 0.008, 95% CI -0.002, 0.02
4. Regression slope = -0.0003, std error = 0.001, 95% CI -0.002, 0.002
5. Regression slope = 0.0078, std error = 0.011, 95% CI -0.013, 0.029
6. Set C (1): Principal diagnosis of injury, contributing diagnosis of mental health disorder. Regression slope = -0.0015, std error = 0.006, 95% CI -0.013, 0.010
7. Set C (2): Principal diagnosis of mental health disorder, contributing diagnosis of injury. Regression slope = -0.033, std error = 0.004, 95% CI -0.041, 0.003

⁹ “Set A Sent” was excluded from this analysis due to extremely small numbers resulted in gross impression in the estimates.

Discussion

In the analysis presented above, we have sought to determine if there have been any changes over time in the following:

- (a) for cases with a principal diagnosis of injury or mental health disorder (or sentinel diagnoses of mental health disorder) and contributing diagnosis of the converse, the percent with a self-harm external cause code, and
- (b) for self-harm cases, the percent with a principal diagnosis of (i) injury or (ii) mental health disorder and a contributing diagnosis of the converse.

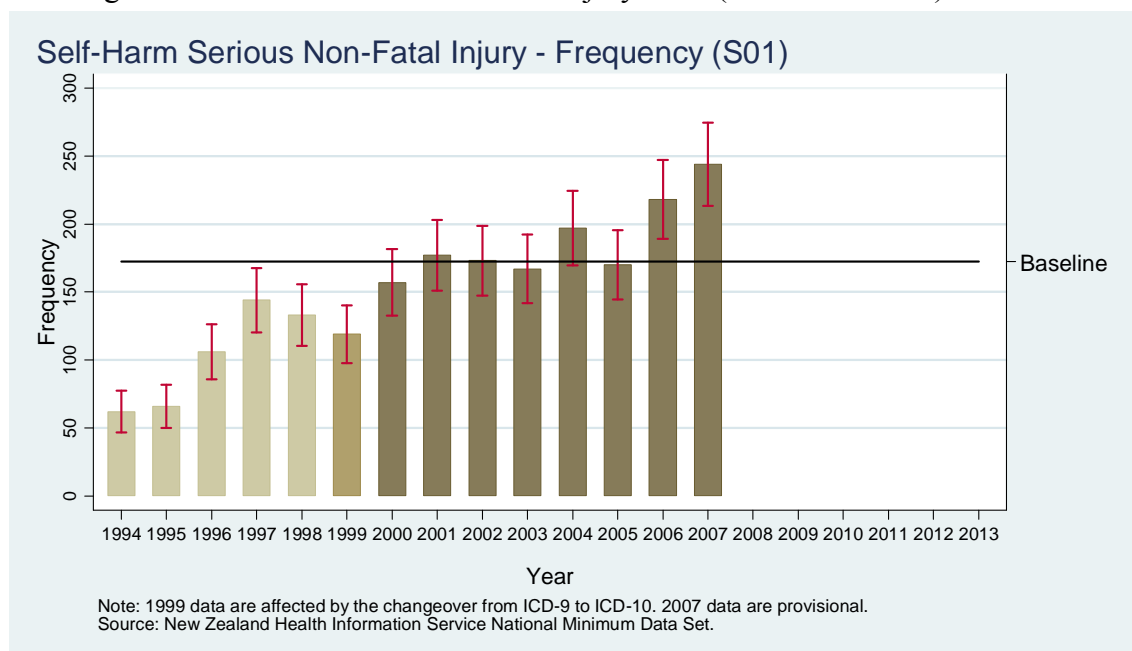
The results show that, although, in some instances, there are differences in coding over time, there were no detectable linear trends that would suggest a systematic change in the way serious non-fatal self-harm injury cases were identified and recorded over time. Regression analysis of the observed trends showed, for the majority of the analyses, the estimated maximum amount of the observed increase in the NZIPS Chartbook indicator for the frequency of serious non-fatal self-harm cases that could be explained was between 4% and 36%, suggesting that the majority of the observed increase was due to other, as yet undetermined factors or a real increase.

“Set A sent” and “Set B sent” combined (Sentinel principal or contributing diagnosis with associated injury diagnosis) explained a maximum of 50% of the observed increase. Therefore, assuming a linear increase in the frequencies of self-harm between 2001 and 2007, changes in the recording of self-harm given a sentinel diagnosis, with an associated injury diagnosis, could explain a significant proportion of the increase in serious non-fatal self-harm frequencies. However, from column 2 in Table 6, it is apparent that there wasn’t a linear increase in the annual frequency of serious non-fatal self-harm cases, and that the increase has largely occurred in the most recent 3 years shown in Figure 4 (2005-2008). No results we found would suggest that these increases beyond 2005 were due to changes in the reporting of self-harm.

These findings (described in the last 2 paragraphs) indicate that we can remove the provisional status of the serious non-fatal self-harm indicator for the period 2001-2007.

The results described only pertain to the time period investigated. The charts for the serious non-fatal self-harm indicators (as for all of the serious non-fatal indicators) begin their time series at 1994. The serious non-fatal self-harm chart from the 2008 Chartbook has been reproduced below as an example (Figure 4). For the period 1994-1999, the National Minimum Data Set used version 9 of the International Classifications of Injury and Diseases coding scheme for recording the diagnosis and external cause for hospital discharges. Version 10 was implemented in 1999-2000, and this resulted in a substantial variation in the frequency of injury. This investigation has focused on the period after the implementation of the ICD-10 coding scheme. As such, if the provisional status of the serious non-fatal self-harm indicator was to be removed, we recommend producing the charts for the period 2001 onwards only. In addition, we recommend repeating this investigation regularly to monitor whether there are systematic changes in the recording of self-harm in the future.

Figure 4: Self-harm serious non-fatal injury chart (2008 Chartbook)



The original analysis plan for the investigation of the provisional status of the self-harm indicators was to investigate trends in the coding of depression and self-harm. This was based on reports¹⁰ that around 50% of self-harm cases have a previous diagnosis of depression (ICD diagnosis code F32-F34). However, in this investigation, for incident cases of serious non-fatal self-harm, depression did not appear to be a good marker for self-harm, especially in the older (>60 yrs) age group where substantial variations existed in the recording of this diagnosis over time. As we were concerned that such variations would impact on the conclusions we could draw from the analysis (i.e. these variations would drive changes in the proportion of self-harm cases with a principal diagnosis of depression or self-harm), the analysis plan was widened to include all mental health diagnoses.

Our investigations revealed that only a small proportion of cases of mental health disorder have an associated self-harm external cause code, suggesting that trends based only on this analysis could be effected by extraneous factors. As such, we sought, and were able to identify, sentinel mental health diagnoses that were markers for self-harm. Over 50% of cases assigned these diagnoses also experienced a self-harm event. As the results for these sentinel diagnoses reflect the results for all mental health disorders, there is additional support for removing the provisional status of the serious non-fatal self-harm indicators.

Tables 2-4 of this report reveal no linear trends for changes in the principal diagnosis of serious non-fatal self-harm events. Annually there were smaller counts of serious non-fatal self-harm cases with a principal diagnosis of mental health disorder which resulted in uncertainty in regard to potential trends. However, it is apparent from Table 2, that although there were differences in the percent of self-harm cases with a principal diagnosis of mental health disorder in 2003 and

¹⁰ Isacson, G. Rich, C.L. (2001) Regular review: Management of patients who deliberately self-harm themselves. *British Medical Journal* 322: 213-215

2004, these differences did not continue throughout the time series.

The primary aim of this investigation was to determine if there had been systematic variations in reporting of self-harm over time. Given that there appeared to be no systematic trend over time in the recording of mental health as a principal diagnosis (as opposed to injury as a principal diagnosis) for recorded serious non-fatal self-harm cases, only Set B (or Set A and B combined) should be used to draw conclusions for the variability in self-harm reporting. There were no linear trends observed for serious non-fatal self-harm cases between 2001 and 2007.

Conclusion

There has been no detectable systematic change over time in the recording of serious non-fatal self-harm cases between 2001 and 2007. As such, we recommend that the provisional status for the serious non-fatal self-harm indicator should be removed. From 2010, we recommend that the chart for the serious non-fatal self-harm indicator should be produced for a time series beginning with 2001. We also recommend that this analysis should be repeated at regular intervals (eg. every two years) to ensure that there are no systematic changes in the way serious non-fatal self-harm cases are recorded in the NMDS in the future.

Section 2:

Investigation of the provisional status of assault indicators

Methods

Diagnoses indicative of assault

The results presented in this section specifically relate to serious non-fatal cases of assault. Unless otherwise specified, these cases have a principal diagnosis in the range S00-T78 and have an associated assault external cause of injury code (X59-Y09). Seriousness is defined in terms of threat to life, whereby a high threat to life is associated with an ICD-10 based injury severity score (ICISS) of 0.941 or less. This equates to a 5.9% (or greater) probability of death.

We sought to conduct this analysis in a similar way as was proposed for the investigation of the provisional status of the self-harm indicators. Specifically, we sought to determine if there were sentinel diagnosis for assault and whether the recording of these diagnoses in association with an assault related external cause of injury code had changed between 2001 and 2007.

Unlike the situation for self-harm, however, we were not aware of diagnosis code(s) that could serve as a marker for assault. There are diagnosis codes that are frequently associated with cases of assault, such as maxillofacial injury¹¹. In addition, Schnitzer and colleagues have suggested that ICD codes for assault are not a sensitive indicator for child maltreatment¹², and that other codes such as ‘short falls with intra-cranial haemorrhage’ should be considered¹³. However, we were uncertain about the proportion of people with these diagnoses codes that had an assault external cause of injury code, as opposed to other external causes of injury such as fall. Consequently, the first step in our investigation was the identification of diagnosis codes (sentinel diagnoses) associated with assault external cause.

1. Identification of sentinel diagnoses for assault cases

We considered it important that extraneous effects would not impact on the non-assault cases associated with possible sentinel diagnoses. Such influences could modify the proportion of cases with the diagnosis that had an assault external cause code, and lead to inappropriate conclusions being drawn about the provisional status of the serious non-fatal assault indicators. Therefore, to be considered a sentinel diagnosis for assault, we sought to identify diagnoses that would satisfy two criteria:

- a) Those diagnoses that most frequently occurred amongst cases coded to assault.
- b) From these diagnoses, those which have a high proportion of assault as the external code.

¹¹ Kieser, J. Stephenson, S. Liston, P.N., Tong, D.C., Langley, J.D. (2002) Serious facial fractures in New Zealand from 1979 to 1998. *International journal of Oral and Maxillofacial Surgery* 31: 206-209.

¹² Schnitzer, P.G., Slusher, P., Van Tuinen, M. (2004) Child maltreatment in Missouri, combining data for public health surveillance. *American Journal of Preventive Medicine* 27(5): 379-384

¹³ Schnitzer, P.G., Slusher, P., Tarlton, M.M., Van Tuinen, M. (2005) ICD codes suggestive of child maltreatment. Paper presented at *National Injury Prevention and Control Conference*. Denver, Colorado. Centres of Disease Control, Department of Health and Human Services. May 9-11.

We hypothesized that there would be different patterns of assault (and hence different injury diagnoses) for different sections of the population. As such, in order to determine the sentinel diagnoses for assault, we tabulated, by age (0-4, 5-14, 15-24, 25-59, 60+ years) and gender, the most frequently recorded principal diagnoses for serious non-fatal injury hospitalisation with an ‘assault’ external cause of injury code for the period 2001-2007 (inclusive).

Table 7 lists the top ten principal diagnoses recorded in serious non-fatal assault hospital discharge records by age group (2001-2007). The most frequently recorded diagnoses by gender are recorded in Table 8. It is apparent that there are substantial differences in the diagnoses recorded for different age groups and genders. Diagnosis codes with a relatively high frequency and proportion associated with an assault external cause code for each age group and gender have been highlighted in yellow. For the 5-14 year old and 60+ age groups there were no diagnoses that were recorded frequently and in a high proportion of assault cases.

Table 7: Top ten principal diagnoses recorded in serious non-fatal assault hospital discharge records by age group^a.

ICD diagnosis code	Diagnosis description	n	% of cases with diagnosis code with assault external cause code
0-4 yrs			
S065	Traumatic subdural haemorrhage	63	45
S020	Fracture of vault of skull	14	4
S0085	Superficial injury to other parts of head (contusion)	11	65
S723	Fracture of shaft of femur	6	30
S021	Fracture of base of skull	6	3
S423	Fracture of shaft of humerus	4	67
S2244	Multiple rib fractures (4 or more)	3	50
S066	Traumatic subarachnoid haemorrhage	3	11
S4241	Supracondylar fracture of humerus	2	100
S501	Contusion of other and unspecified parts of forearm	2	100
5-14 yrs			
S0085	Superficial injury to other parts of head (contusion)	12	32
S0601	Concussion with open intracranial wound	8	9
S021	Fracture of base of skull	8	3
S065	Traumatic subdural haemorrhage	6	8
S701	Contusion of thigh	5	56
S0260	Fracture of mandible, part unspecified	5	17
S0602	Concussion	4	5
S001	Contusion of eye and periorcular area	3	50
S300	Contusion of lower back and pelvis	3	50
S0603	Loss of consciousness of moderate duration (30 min-24 hrs)	3	19

15-24 yrs			
S0601	Concussion with open intracranial wound	170	38
S024	Fracture of malar and maxillary bones	135	50
S021	Fracture of base of skull	113	28
S010	Open wound of scalp	110	46
S0260	Fracture of mandible, part unspecified	105	60
S023	Fracture of orbital floor	71	65
S022	Fracture of nasal bones	69	51
S020	Fracture of vault of skull	60	33
S0085	Superficial injury of other parts of head	54	68
S270	Traumatic pneumothorax	54	33
25-59 yrs			
S024	Fracture of malar and maxillary bones	258	44
S0601	Concussion with open intracranial wound	242	38
S021	Fracture of base of skull	148	24
S010	Open wound of scalp	139	39
S065	Traumatic subdural haemorrhage	121	26
S023	Fracture of orbital floor	104	57
S020	Fracture of vault of skull	97	32
S022	Fracture of nasal bones	89	42
S028	Fracture of other skull and facial bones	85	51
S0260	Fracture of mandible, part unspecified	81	56
60+ yrs			
S065	Traumatic subdural haemorrhage	18	2
S024	Fracture of malar and maxillary bones	16	12
S7211	Fracture of intertrochanteric section of femur	9	0
S022	Fracture of nasal bones	8	9
S028	Fracture of other skull and facial bones	7	18
S066	Traumatic subarachnoid haemorrhage	6	3
S7203	Fracture of subcapital section of femur	6	0
S0601	Concussion with open intracranial wound	5	4
S010	Open wound of scalp	5	3
S0602	Concussion	3	5

^a Assault cases are defined as those serious non-fatal hospital discharges with a principal diagnosis in the range S00-T78 (injury) and a first listed external cause of injury code in the range X59-Y09

Table 8: Diagnosis codes by gender for hospital discharge records with an assault external cause code (2001-2007)

ICD diagnosis code	Diagnosis description	n	% of total for gender
Males			
S024	Fracture of malar and maxillary bones	371	45
S0601	Concussion with open intracranial wound	344	36
S021	Fracture of base of skull	253	21
S065	Traumatic subdural haemorrhage	215	20
S010	Open wound of scalp	195	37
S0260	Fracture of mandible, part unspecified	172	56
S023	Fracture of orbital floor	158	55
S020	Fracture of vault of skull	156	18
S022	Fracture of nasal bones	136	42
S028	Fracture of other skull and facial bones	116	47
Females			
S0085	Superficial injury of other parts of head	81	52
S0601	Concussion with open intracranial wound	81	21
S010	Open wound of scalp	63	21
S065	Traumatic subdural haemorrhage	45	8
S024	Fracture of malar and maxillary bones	42	20
S022	Fracture of nasal bones	32	24
S099	Unspecified injury of head	27	22
S270	Traumatic pneumothorax	25	14
S021	Fracture of base of skull	25	6
S0005	Superficial injury of lip and oral cavity	24	44

As highlighted above, in order to choose sentinel diagnoses, we sought those that were recorded with a high frequency over the 8 years under investigation (2001-2007) and for which a high proportion of the serious non-fatal cases recorded had an assault external cause code. For males, “fractures of the malar and maxillary bones”, “fracture of the mandible, part unspecified” and “fracture of the orbital floor” fulfilled both of these criteria. For the females, only “superficial injuries of other parts of the head” and “concussion with an open intracranial wound” were recorded by at least 10 cases per year (on average). “Superficial injury of other parts of the head” was the only diagnosis code in which more than 50% of the serious non-fatal cases with this principal diagnosis also had an assault external cause code.

Because of low frequency of female serious non-fatal assault cases, we investigated the whole population using those high frequency, high proportion of assault diagnoses identified in males. Over both genders, S0260 (“fracture of the mandible, part unspecified”) and S023 (“fracture of the orbital floor”) had approximately 50% of serious non-fatal cases associated with an assault external cause code. These two codes were considered our sentinel diagnoses.

As neither of the selected codes were listed in the top ten diagnoses for females, this precluded separate analyses by gender. Therefore, in order to provide some insight into the variability of the assault indicator for other hospital discharges (rather than just males aged 25-59 years), we also conducted the analysis using all of the highlighted diagnoses from the tables above (herein referred to as 'high frequency diagnoses').

2. Variation in the proportion of cases with an assault external cause code over time

For each sentinel diagnosis (S0260 and S023), and for the group of high frequency diagnoses, we investigated the proportion coded to assault for serious non-fatal hospital admissions since 2001.

Statistical analysis

Chi-squared tests and non-parametric tests for trend were used to test the hypothesis of no change in the proportion of cases assigned an external cause of injury code of assault over time. For a given aggregation of sentinel diagnoses / highlighted diagnoses, a significant linear trend in the proportion of cases assigned an assault external cause code provides evidence to indicate that the recording of assault is dependent on external influences (such as increased social acceptability of reporting assaultive events).

Results

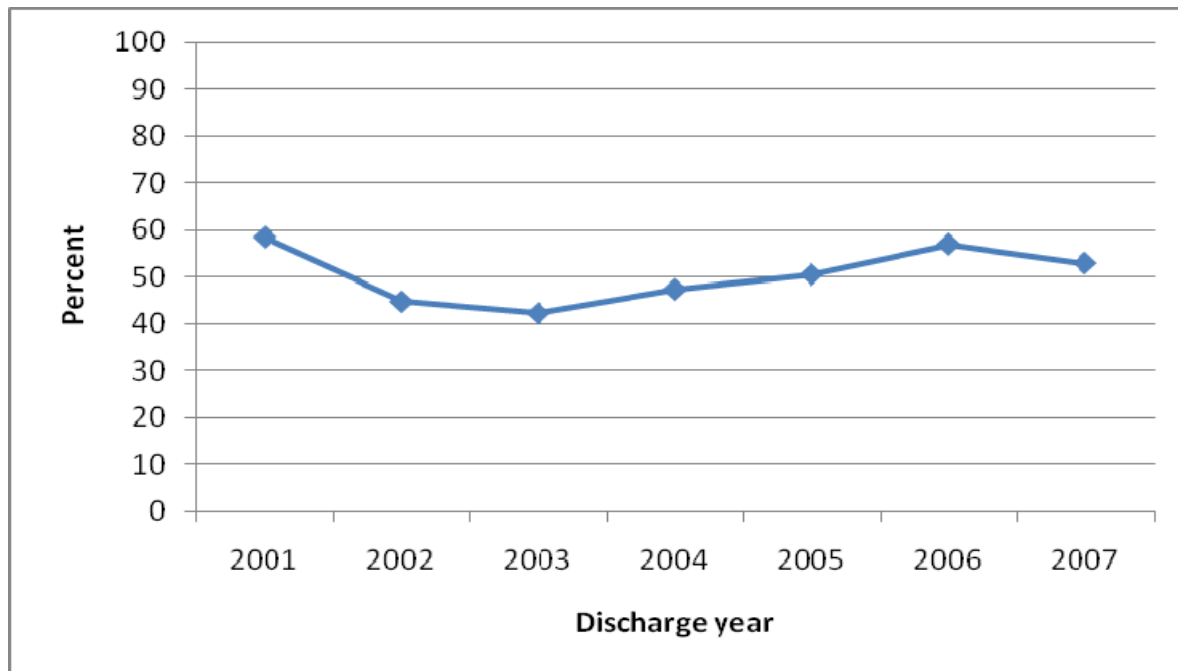
Trends in assault recording over time

Table 9 presents the proportion of assault cases for the population of serious non-fatal hospitalizations with either of the sentinel diagnoses between 2001 and 2007. There was no significant difference between years in the proportions (chi 2 (6df) = 2.8, p=0.8), nor was there any detectable linear trend over time (chi 2 (1df) = 0.76, p=0.4). The trend for the proportion of assault related serious non-fatal ‘S023’ or ‘S0206’ cases is presented diagrammatically in Figure 5.

Table 9: Serious non-fatal cases with a principal diagnosis of ‘S024’ or ‘S0206’

Assault external cause code	Year of discharge						
	2001	2002	2003	2004	2005	2006	2007
No	50	43	42	57	76	82	63
%	41	36	35	41	40	43	41
Yes	71	77	77	82	114	110	90
%	59	63	65	59	60	57	59
Total	121	120	119	139	190	192	153

Figure 5: Percent serious non-fatal events with a principal diagnosis of ‘S024’ and ‘S0206’ that were assault related.



The proportion of assault cases for the population of serious non-fatal hospitalizations with any of the high frequency diagnoses is presented in Table 10. Again, there was no difference between the years in the proportions with an assault external cause code (chi 2 (7df) = 11.71, p=0.1), nor was there any significant linear trend across the years identified (chi 2 (1df) = 0.1, p=0.7).

Table 10: Serious non-fatal assault cases with ‘high frequency’ diagnoses^a

High frequency diagnosis	Year of discharge						
	2001	2002	2003	2004	2005	2006	2007
No	461	483	451	462	539	605	616
%	68	70	70	64	67	66	68
Yes	214	203	195	260	269	310	306
%	32	30	30	36	33	34	32
Total	675	686	646	722	808	915	915

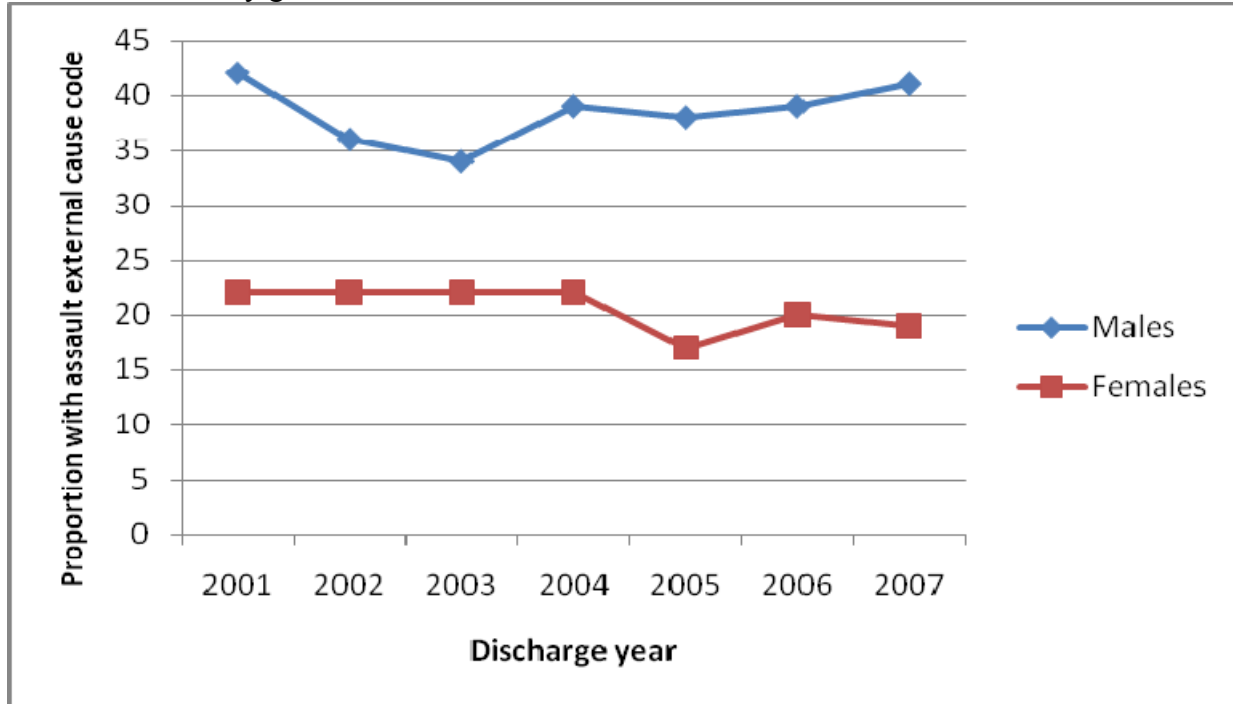
^a ‘High frequency’ diagnoses were:
‘S0085’ Superficial injury of other parts of head
‘S010’ Open wound of scalp
‘S022’ Fracture of nasal bones
‘S023’ Fracture of orbital floor
‘S024’ Fracture of malar and maxillary bones
‘S0260’ Fracture of the mandible, part unspecified
‘S028’ Fracture of other skull and facial bones
‘S065’ Traumatic subdural haemorrhage

To determine if there were any differences in the trends observed by gender, the analysis for the high frequency diagnoses was repeated for males and females separately. For males and females (chi 2 (6df) = 9.4, p = 0.2; chi 2 (6df) = 3.5, p = 0.7, respectively) there was no significant difference in the proportions between the years. Across time, there was no linear trend for either males or females (chi 2 (1df) = 0.2, p = 0.6; chi 2 (6df) = 1.3, p = 0.2, respectively). This is displayed diagrammatically in Figure 6.

Table 11: Proportion of serious non-fatal high frequency diagnoses with an assault external cause code by gender

Gender	Year of discharge						
	2001	2002	2003	2004	2005	2006	2007
% with assault external cause code							
Males	42	36	34	39	38	39	40
Females	22	22	22	22	17	20	19

Figure 6: Proportion of serious non-fatal high frequency diagnoses with an assault external cause code by gender



We sought to investigate whether the small numbers presented for some of the analyses above masked trends in reporting that may be impacting on the frequencies of serious non-fatal assault injuries. To do this we calculated a regression line with confidence intervals for each analysis. The upper confidence interval was considered the ‘worst case’, that would give the most extreme example of the impact of changes in recording. In Table 12, the trend in annual frequencies of serious non-fatal assault between 2001 and 2007 has been for each of the above analyses has been predicted using the upper confidence interval.

Table 12 shows that, compared with column 2 (the frequency of serious non-fatal assault as recorded in the 2008 Chartbook), the regression line for the sentinel diagnoses explained a very small proportion of the increase in the annual frequencies of serious non-fatal assault. In the case of the high frequency diagnoses, the regression line predicted a decrease in the annual frequencies of serious non-fatal assault cases, contrary to what was observed.

Table 12: Impact of identified trend on serious non-fatal assault frequencies as recorded in 2001.

Year	Current frequency	Sentinel diagnoses ¹	High frequency diagnoses ²
2001	675	675	675
2002	686	676	685
2003	646	676	695
2004	722	677	706
2005	808	678	716
2006	915	678	727
2007	915	679	738
Increase (2001-2007)	240	4	63
% change relative to Chartbook increase		2%	26%

1. Regression slope = -0.002, std error = 0.006, 95% CI -0.013, 0.001

2. Regression slope = 0.009, std error = 0.003, 95% CI 0.003, 0.015

Discussion

Unlike the situation for the serious non-fatal self-harm cases, we were not aware of a diagnosis code specifically related to an assault external cause code. Sentinel diagnoses for assault cases were identified by listing the most frequently recorded principal diagnoses for assault cases and then identifying, from the list generated, those diagnoses with a high proportion with assault as the external cause code. We also investigated the trends in assault coding for diagnoses frequently associated with this external cause code ('high frequency' diagnoses).

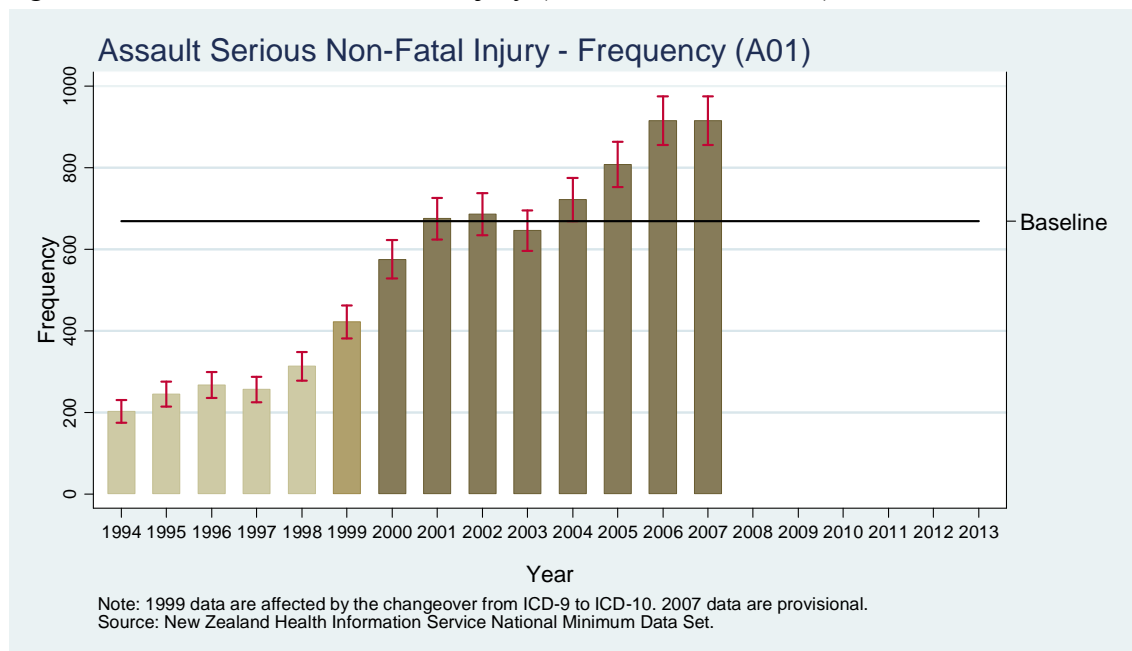
Although Table 7 shows a different pattern of injury for different age groups and genders, the small numbers in the majority of the age groups and for females, and the low proportion of any of these diagnosis codes being associated with assault precluded their use as a 'sentinel diagnosis' for the purposes of this investigation. However, we were able to investigate differences across genders by also including the high frequency diagnoses in the analysis.

There were no detectable differences or trends for changes in the proportion of recorded assault cases with a principal diagnosis of S023 ("fracture of the orbital floor") or S0206 ("fracture of the mandible, part unspecified"), as shown in Table 9 and Figure 5. In addition, there were no changes in the proportion of recorded assault with at least one of the high frequency diagnoses. Nor were there any detectable differences in the proportion of high frequency diagnoses associated with an assault external cause code for males and females separately. These results suggest that there have been no important changes in reporting of assault for these marker diagnoses during this period, indicating that the provisional status can be removed from this serious non-fatal indicator for 2001-2007.

Removal of the provisional status is further substantiated by the regression analysis presented in Table 12. Changes in the recording of S023 and S0206 in association with an assault external cause code explained only 2% of the increase in the observed annual frequencies in serious non-fatal assault cases, as presented in the Chartbooks.

As with the serious non-fatal self-harm indicators, our results above pertain only to the time period investigated. The charts for the serious non-fatal assault indicators (as for all of the serious non-fatal indicators) begin their time series at 1994 (Figure 7). For the period 1994-1999, the National Minimum Data Set used version 9 of the International Classifications of Injury and Diseases coding scheme for recording the diagnosis and external cause for hospital discharges. Version 10 was implemented in 1999-2000, and this resulted in a substantial variation in the frequency of injury. This investigation has focused on the period after the implementation of the ICD-10 coding scheme. As such, if the provisional status of the serious non-fatal assault indicator was to be removed, we recommend producing the charts for the period 2001 onwards only. In addition, we recommend repeating this investigation regularly to monitor whether there are systematic changes in the recording of assault into the future.

Figure 7: Assault serious non-fatal injury (draft Chartbook 2008)



There are limitations associated with this investigation. Firstly, identification of hospitalized assault cases depends on the ability of the patient to disclose the reasons for their injuries and/or the astuteness of the attending physician. It is possible that more of the cases with the diagnoses listed above were related to assault. We sought to determine if there had been changes in the reporting of assault for two sentinel diagnoses, and for a group of high frequency diagnoses, and no variations were identified. This finding does not suggest that there have been no changes in the proportion of cases with these diagnoses associated with an assaultive event, only that there have been no changes in the proportion of patients with these diagnoses that report the injury was the result of an assault.

The sentinel diagnoses that were identified were predominant in males and in the 15-24 and 25-59 year old age groups, primarily because these groups have the highest frequency of recorded serious non-fatal assault cases. It is possible that there were changes in reporting rates for other vulnerable sectors of the population (such as young children), however, small numbers of young children with an assault external cause resulting in serious injury prevented a detailed analysis of the sentinel diagnosis associated with assault for this group. As highlighted above, we were able to investigate whether there had been any changes in the proportion of high frequency diagnoses associated with an assault external cause code in women, and no significant differences were identified.

The limitation highlighted above (small numbers for children) may raise the question of whether this analysis has been able to provide an evaluation of the provisional status of the serious non-fatal assault indicators. We argue that it has for the following reason. The assault indicators were assigned provisional status because a concern that extraneous factors, such as changing social norms, would impact on the time-series of frequencies and age standardized rates. This analysis has shown that males, and those aged 25-59 years are the main drivers of the frequencies and the

rates for serious non-fatal hospitalized assault cases in New Zealand. This analysis did not find evidence of changing reporting rates over time. If extraneous factors such as increased social support are increasing the likelihood of reporting assault for children (which we have not been able to establish through this research), because of the low frequency of assault for children, these extraneous factors are not likely to impact on the time series presented in the Chartbooks.

Conclusion

There has been no detectable systematic change in the recording of assault cases resulting in serious non-fatal injury between 2001 and 2007. As such, we recommend that the provisional status for the serious non-fatal assault indicator should be removed. From 2010, we recommend that the serious non-fatal assault chart should be produced for the time series beginning 2001. We also recommend that this analysis should be repeated at regular intervals (eg. every two years) to ensure that there are no systematic changes in the way serious non-fatal assault cases are recorded in the NMDS in the future.