Improving efficiency and underpinning transparency in research: enhancing research resources via a research repository

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Abstract

Hospital discharge data has been widely used to study and estimate health care delivery as it changes through the years. Research into this field allows for policy development and analysis useful for both the consumer and provider. The National Minimum Data Set (NMDS) is a large data set containing information on hospital events that have occurred at every public and private hospital in New Zealand. The Enhancing Hospital Outcomes (EcHO) project was designed to analyse the quality of patient care in New Zealand using indicators to measure a variety of health conditions and events. Before developing methods to approach this task, care needed to be taken in applying analyses to the NMDS, given that the data collection spanned years of changing coding practices and the creation of new diagnostic categories. These changes highlight the need for data filtering. The Ministry of Health (MoH) has reported their filtering techniques of the NMDS and code was developed to replicate the process to enable more accurate estimates.

Through close inspection of the related MoH filtering publications, inconsistencies were found in their figures raising doubt when trying to reproduce the computer code. Despite this, figures were compared and for most categories filtering exclusions numbers from the EcHO project were similar to those released by the MoH. Categories that were found to produce dissimilar results to the MoH figures were error diagnosis-related groups (DRGs), endoscopic retrograde cholangio pancreatography (ERCPs), inconsistent stays, mental health cases and disability support services cases (DSS)

Allowing public access to these developed methods of filtering and healthcare quality indicators was a main objective to the project. Hypertext Markup Language, or HTML, code was written to publish the SAS code for the EcHO project on the website belonging to the New Zealand Social Sciences Data Service (NZSSDS, found at: http://www.nzssds.org.nz).

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Project Aims

The New Zealand Social Science Data Service (NZSSDS) is a service on the web (www.nzssds.org.nz) that seeks to provide researchers with methods and data that have been analysed and trialled previously. Supplying well-documented work would enable cross validation of tried methods and also save time and resources for other researchers who wish to perform similar analyses using more updated versions of the data sets. Comparability is a big issue when working with the NMDS so collaboration on the filtering methods would enable a more uniform approach to be developed amongst those researchers wishing to analyse the data. The filtering code and other methods used were compiled into a user-friendly format available for download online.

1 Introduction

Accessibility to research methods has been long required as a form of collaboration to improve theory and ideas. Partially completed through published literature and media spotlight, the ability to increase awareness on tested methods and to gain knowledge in the area is invaluable.

The New Zealand Social Sciences Data Service (NZSSDS) is a website developed by COMPASS dedicated to providing a portal to researchers and scientists wishing to make their work publicly available. The accessibility of the work saves time and resources for those wishing to perform similar analyses. Data, methods and results are available online for users who wish to see professional research carried out through different types of social surveys.

A project that was carried out and published on the NZSSDS website, called ‘Enhancing Hospital Outcomes’ (EcHO) made use of hospital discharge data and methods that can be used to analyse it. The project sought to establish valid

methods of assessing patient quality of care, and whether the financial investment over the recent years had the desired output.

Hospital discharge data was retrieved through the National Minimum Data Set (NMDS) which is managed by the Ministry of Health (MoH). The NMDS contained cases for every event that has required hospital treatment in New Zealand and is used regularly by researchers both internally and externally within the MoH to analyse medical trends and aid policy development, (Poole et al., 2009). Variables such as age, sex and ethnicity are recorded along with procedure codes, diagnostic codes and the event start and end dates.

In analysing the NMDS, the MoH applies various filters to the data to allow for comparability across years of data collection. The filtering attempts to remove any effects that may be introduced from changes in coding practice and patient categories through the different periods of hospital events (Katzenellenbogen, Baxendine, Cheung, Pool, & Jackson, 2001b). While the MoH does release a description of the filtering process, the actual computer code is omitted so every attempt to replicate closely the underlying concepts has been made (Ministry of Health, 2006b).

In this report I will discuss the tasks I worked on and the areas related to the effort of dissemination of data and methods. Introduced firstly is the project that the research and methods focussed on, Enhancing Hospital Outcomes, followed by a section describing the data set that the analyses used, the National Minimum Data Set. Examined in the next section is the website which the work was uploaded onto – the New Zealand Social Science Data Service, followed by the concluding discussion and any limitations I encountered while working on the research project.

2 Enhancing Hospital Outcomes

The Enhancing Hospital Outcomes (EcHO) project was initiated to utilise hospital discharge data and other data sources such as the mortality data set to allow for investigation into patient quality of care, throughput, and output for the financial years 2001 to 2009.

Given the increase of investment into the health sector over the previous years, the project also aimed to determine whether this had an effect on output and the volume of people receiving needed care.

Patient Indicators

Indicators were pre-developed using SAS to estimate various components determining quality of care. These indicators included preventable hospitalisations and avoidable mortality. Preventable hospitalisations encompass topics such as ambulatory sensitive cases and diabetes complications (Page, Ambrose, Glover, & Hetzel, 2007). These are cases where simple vaccinations or lifestyle and diet management would have prevented the hospitalisation. Avoidable mortality indicators summarise a set of conditions where mortality should be largely reduced given current availability of health services (Page et al., 2006). Comorbidity indicators were also developed to help determine the variables associated with high resource costs and length of stay in the hospital (Elixhauser, Steiner, Harris, & Coffey, 1998). These comorbidities could then be used to predict the likely cost of a community requiring ongoing treatment.

Output was also estimated using variables such as length of stay and calculating the average number of beds used per day. These variables were created to quantify the efficiency of the health sector and seek variables that were associated with an increase in the throughput.

Other indicators that were produced were those signalling readmissions and mortality. Readmissions were either planned or unplanned and had to occur within 30 days of their last discharge. Mortality figures included in-hospital death and 30, 60 or 90 day mortality since the admission date.

The EcHo project used ICD codes from published resources for each of the medical conditions, referenced on the introduction of each indicator (appendix Figure 1).

3 The National Minimum Data Set

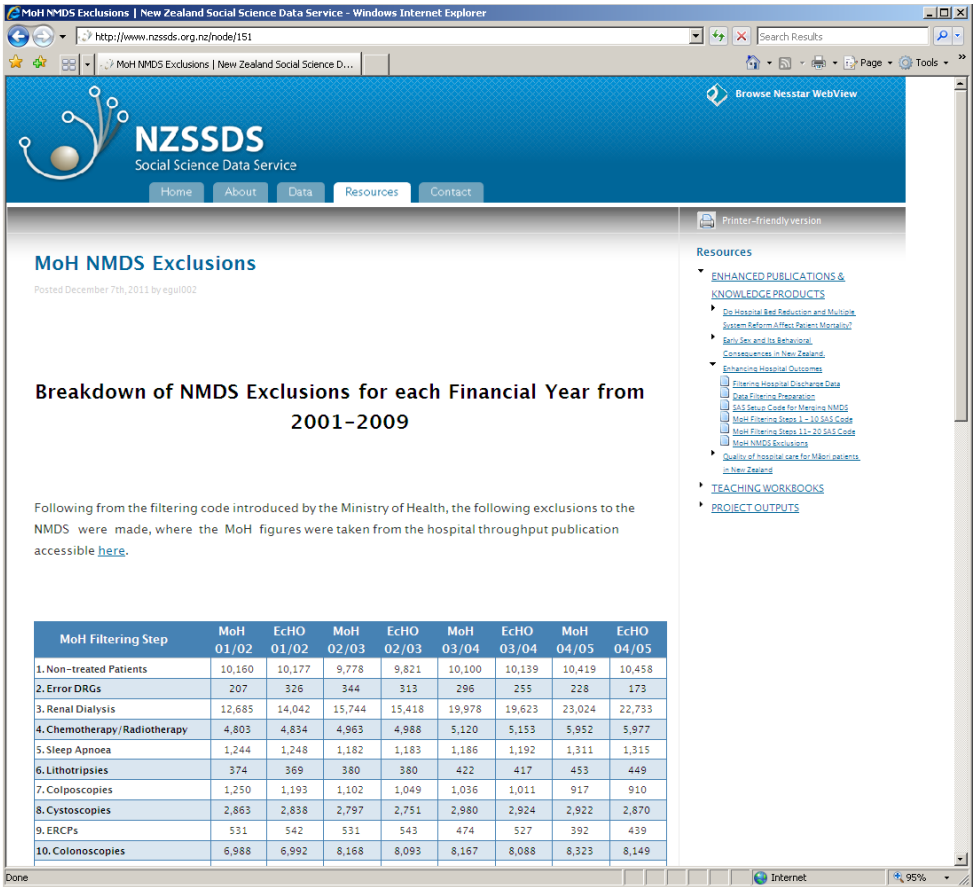
The National Minimum Data Set (NMDS) is a large database containing discharge information from the public and private hospital sector. Detailed information is recorded on all aspects of the patient's event such as demographics to the multiple diagnoses made. A patient can have multiple events requiring hospital care throughout the year resulting in different cases with a common identifier. The MoH monitors the NMDS and receives the data at regular intervals from the different health providers around New Zealand. Public hospitals are required to process a new event within 21 days after the month of discharge and a slightly longer grace period is given to private health organisations (Ministry of Health, 2012).

The NMDS was established in 1993 and contains data recorded as early as 1988 (Ministry of Health, 2012). Since then, various aspects about the data have changed and thus affected the year-to-year comparability (Katzenellenbogen, et al., 2001b). These changes include modifications to the International Coding of Disease (ICD) over the years, from 1999 onwards, ICD-10 was adopted and updated the ICD-9CM version. The newer coding system allowed for more specific diagnoses, possibly affecting the number of cases in different diagnostic groups. Other aspects that were changed that affected the NMDS were the introduction of new categories such as well babies. Well babies are classified as healthy newborns delivered in hospital but their registration did not start until 1991 so for analyses through the duration of data

collection, these units should be removed (Katzenellenbogen, Baxendine, Cheung, Pool, & Jackson, 2001a).

The MoH has published a series of steps that are carried out before performing analyses on the NMDS (Ministry of Health, 2006b). These steps are divided into the categories containing units that are removed from the NMDS, 20 of which have been released. With each step, a blurb stating the ICD codes that make up each category was included which has been followed to produce the exclusions given in Table 1 and 2. The justification of removing these units varies within each type, the underlying concept is that for analyses performed on the data to be comparable from year to year, the cases analysed must be as similar as possible over time. If these cases are not kept similar, any significant differences within categories between years could be attributed to these changes in diagnostic coding or other aspects that have been altered through the data collection years.

Figure 1 – MoH NMDS Exclusions: this page shows two tables of NMDS exclusions from 2001 to 2009.



MoH Filtering Step	MoH 01/02	EcHO 01/02	MoH 02/03	EcHO 02/03	MoH 03/04	EcHO 03/04	MoH 04/05	EcHO 04/05
1. Non-treated Patients	10,160	10,177	9,778	9,821	10,100	10,139	10,419	10,458
2. Error DRGs	207	326	344	313	296	255	228	173
3. Renal Dialysis	12,685	14,042	15,744	15,418	19,978	19,623	23,024	22,733
4. Chemotherapy/Radiotherapy	4,803	4,834	4,963	4,988	5,120	5,153	5,952	5,977
5. Sleep Apnoea	1,244	1,248	1,182	1,183	1,186	1,192	1,311	1,315
6. Lithotripsies	374	369	380	380	422	417	453	449
7. Colposcopies	1,250	1,193	1,102	1,049	1,036	1,011	917	910
8. Cystoscopies	2,863	2,838	2,797	2,751	2,980	2,924	2,922	2,870
9. ERCPs	531	542	531	543	474	527	392	439
10. Colonoscopies	6,988	6,992	8,168	8,093	8,167	8,088	8,323	8,149

Table 1 – NMDS exclusions for the MoH filtering steps 1 to 20, except step 18 (transfers). Alternating columns are to compare the released MoH figures, from the 04/05 hospital throughput publication, with those figures obtained by the EcHO project. Total row is the sum of the exclusions minus those with multiple exclusion codes.

MoH Filtering Step	MoH 01/02	ECHO 01/02	MoH 02/03	ECHO new	MoH 03/04	ECHO 03/04	MoH 04/05
1. Nontreated patients	10,160	10,177	9,778	9,821	10,100	10,139	10,419
2. Error DRGs	207	326	344	313	296	255	228
3. Renal dialysis	12,685	14,042	15,744	15,418	19,978	19,623	23,024
4. Chemo/Radiotherapy	4,803	4,834	4,963	4,988	5,120	5,153	5,952
5. Sleep apnoea	1,244	1,248	1,182	1,183	1,186	1,192	1,311
6. Lithotripsies	374	369	380	380	422	417	453
7. Colposcopies	1,250	1,193	1,102	1,049	1,036	1,011	917
8. Cystoscopies	2,863	2,838	2,797	2,751	2,980	2,924	2,922
9. ERCPs	531	542	531	543	474	527	392
10. Colonoscopies	6,988	6,992	8,168	8,093	8,167	8,088	8,323
11. Gastroscopies	8,197	8,144	8,539	8,439	7,949	7,867	8,089
12. Bronchoscopies	1,693	1,709	1,700	1,710	1,795	1,824	1,779
13. Blood Transfusions	5,829	5,825	6,248	6,260	6,422	6,431	6,159
14. Inconsistent stays	216	215	154	227	127	240	344
15. Well babies	35,150	35,073	35,024	34,886	36,288	35,984	36,591
16. Mental Health	10,551	9,718	10,661	9,773	10,584	9,891	17,228
17. DSS	18,447	23,157	17,182	23,233	15,309	22,142	15,412
19. A&E/Short Stay Obs	34,446	35,050	35,381	35,778	37,156	37,546	41,920
20. Overseas patients	24,456	1,766	23,733	1,974	23,650	1,939	25,421
Total	179,415	162,141	183,001	165,690	188,870	172,293	203,657

Table 2 – Similar as for table 1 but for years 2005 to 2009. No MoH exclusion figures were available to make comparisons for these years.

MoH Filtering Step	ECHO 05/06	ECHO 06/07	ECHO 07/08	ECHO 08/09
1. Nontreated patients	10,450	9,790	10,554	11,218
2. Error DRGs	45	55	43	48
3. Renal dialysis	24,911	25,921	16,106	16,759
4. Chemo/Radiotherapy	7,351	7,916	8,534	8,365
5. Sleep apnoea	1,335	1,300	1,308	1,564
6. Lithotripsies	374	441	451	497
7. Colposcopies	937	834	864	798
8. Cystoscopies	2,459	2,522	2,459	2,222
9. ERCPs	397	411	408	479
10. Colonoscopies	9,007	9,483	10,659	11,537
11. Gastroscopies	8,044	7,810	8,389	9,073
12. Bronchoscopies	1,607	1,676	1,716	1,833
13. Blood Transfusions	6,345	6,569	6,541	6,663
14. Inconsistent stays	218	298	119	6
15. Well babies	37,039	37,726	41,373	40,748
16. Mental Health	9,477	9,748	9,671	9,921
17. DSS	20,294	20,934	20,212	20,436
19. A&E/Short Stay Obs	48,321	50,964	52,999	84,385
20. Overseas patients	3,190	3,511	3,462	3,606
Total	189,914	195,747	193,834	227,800

After the filtering was applied to the NMDS, the exclusion figures in each category were compared to those released in MoH hospital throughput publications (Table 3). Firstly, it was noticed that the numbers in each filter category were slightly different to those in the same category, and same year but different publication. These small differences could be due to slight changes in the cases added to the NMDS over time, as the data set is continuously being updated with hospital events that may not have made it in time before the analyses were performed. However, it was noted that for the categories; 14 Inconsistent stays, 15 Well babies and 18 Transfers, the figures changed significantly between different throughput publications. In Table 3 it shows that the number of cases excluded in the financial year 2000/2001 for inconsistent stays was 1,165 as stated in the 01/02 and 02/03 hospital throughput publications but for that same financial year the figures in the 03/04 and 04/05 publications state only 405 exclusions. For category 15 (well babies), the respective figures were 37,107 compared with 35,228 and for category 18 – transfers, the respective figures were 7,406 compared with 21,174 exclusions (Ministry of Health, 2004a, 2004b, 2006a, 2006b).

Filtering Issues Encountered

Inconsistencies within the filtering performed by the MoH prompt the question as to whether it is realistic to aim for the results released in the publications. Despite this, most of the categories that code was developed for produced similar exclusion figures when compared to the MoH publications (Table 1). Because the last hospital throughput publication released was for the financial year 2004/2005, and the data that was used for the EcHO project spanned from 2001 to 2009, only the filtered cases for the financial years 2001 to 2005 were compared with the MoH released figures. For the categories; 1 Non-treated patients, 3 Renal dialysis, 4 Chemotherapy/Radiotherapy, 5 Sleep apnoea, 6 Lithotripsies, 7 Colposcopies, 8 Cystoscopies, 10 Colonoscopies, 11 Gastroscopies, 12 Bronchoscopies, 13 Blood transfusions, 15 Well babies, 19 A&E/Short stay observations and 20 Overseas patients it can be seen that the difference between the two figures (EcHO and MoH) is small whereas for categories; 2 Error DRGS, 9 ERCPs, 14 Inconsistent Stays, 16 Mental Health and 17 DSS the differences between the MoH figures and EcHO are more considerable.

It should be pointed out that for the mental health cases, a jump in cases occurred from 10,584 for the year 03/04 to 17,228 in 04/05 (Table 1). Because the last publication released on hospital throughput was the 04/05 version, the accuracy of this observation could not be verified through a later MoH filtering release. The only relevant MoH hospital throughput publications found were released in 2001/2002, 2002/2003, 2003/2004 and 2004/2005 that contained filtering figures for the NMDS (Ministry of Health, 2004a, 2004b, 2006a, 2006b).

Step 18 involved Transfer cases, patients who had multiple records for a single procedure or condition as a result of being transferred between specialist hospitals during treatment. The description of this category was unable to be interpreted into code therefore there was no category 18 to compare with any of the MoH releases.

Table 3 – MoH Inconsistent NMDS Exclusions: This table shows the NMDS exclusions for each category for the financial years 2000/01 and 2001/02, by hospital throughput publications for years 2001/02, 2002/03, 2003/04, and 2004/05.

Category	Hospital Throughput Publication							
	01/02	02/03	03/04	04/05	01/02	02/03	03/04	04/05
	NMDS exclusions for the financial year							
	00/01	00/01	00/01	00/01	01/02	01/02	01/02	01/02
1. Non-treated Patients	10,393	10,393	10,357	10,357	10,201	10,201	10,160	10,160
2. Error DRGs	197	197	190	190	219	219	207	207
3. Renal Dialysis	11,773	11,773	11,746	11,746	12,709	12,709	12,685	12,685
4. Chem/Radiotherapy	4,574	4,574	4,571	4,571	4,811	4,811	4,803	4,803
5. Sleep Apnoea	1,159	1,159	1,157	1,157	1,247	1,247	1,244	1,244
6. Lithotripsies	365	365	364	364	374	374	374	374
7. Colposcopies	1,488	1,488	1,448	1,448	1,252	1,252	1,250	1,250
8. Cystoscopies	2,852	2,852	2,851	2,851	2,865	2,865	2,863	2,863
9. ERCPs	548	548	542	542	541	541	531	531
10. Colonoscopies	6,370	6,370	6,365	6,365	6,994	6,994	6,988	6,988
11. Gastroscopies	8,299	8,299	8,282	8,282	8,217	8,217	8,197	8,197
12. Bronchoscopies	1,701	1,701	1,685	1,685	1,701	1,701	1,693	1,693
13. Blood Transfusions	5,012	5,012	5,005	5,005	5,840	5,840	5,829	5,829
14. Inconsistent Stays	1,165	1,165	405	405	1,118	1,118	216	216
15. Well Babies	37,107	37,107	35,228	35,228	37,112	37,112	35,150	35,150
16. Mental Health	8,323	8,323	8,893	8,893	9,634	9,634	10,551	10,551
17. DSS	15,713	15,713	16,143	16,143	17,761	17,761	18,447	18,447
18. Transfers	7,406	7,406	21,174	21,174	8,703	8,703	22,617	22,617
19. A&E/Short Stay Obs	28,152	28,152	27,794	27,794	35,047	35,047	34,446	34,446
20. Overseas Patients	2,137	2,137	2,468	2,468	2,105	2,105	2,410	2,410

4 The New Zealand Social Science Data Service

The New Zealand Social Science Data Service (NZSSDS) is a website dedicated to providing access to the wider research community, resources and methods used by fellow scientists. Data sets are stored along with SAS and SPSS computer code for programs that were developed by statisticians working for the Centre of Methods, Policy Application in the Social Sciences (COMPASS). Information on surveys that have been carried out is also available for study and as a guide to survey design for other researchers.

There are several sections on the NZSSDS website that link into the data holdings and teaching resources. The section involved with the EcHO project is under "Browse Enhanced Publications" which holds the web pages designed to contain the MoH filtering performed on the NMDS (see appendix Figure 2).

As a part of this summer project, new web pages were added to the NZSSDS website to share the methods used to filter the NMDS and indicator code used to analyse patient safety and throughput (found at: http://www.nzssds.org.nz/node/141).

Hyper Text Markup Language

The code used to create the web pages was Hyper Text Markup Language (HTML). The text editor available with the NZSSDS website did not give the required ease of functionality when trying to apply styles to the different pieces of SAS code. SAS code is known to contain different syntax highlighting dependent on the pieces of the function called. Used in the Indicator and MoH filtering SAS code were all the ICD-10 codes used to describe each medical condition, and these were HTML coded manually with styles created every time a change in colour or font occurred. In Figure 9 of the appendix the style sheet can found at the top of the HTML code section within both the head tag (`<head>`) and style tag (`<style>`). Span elements (`<span>`) were used to style the SAS code whereas paragraph elements (`<p>`) were

used for the green commenting, the normal text and headings. Every time a new style was needed, a new span tag was written and defined by the class name as to what attributes it holds. With the ICD-10 codes in particular, this was fairly time consuming and inefficient. The ability however to control each aspect of the page content was superior by far to using an automated text editor.

When the HTML code for the webpages describing the indicators was created, the amount of ICD-10 codes that were needed increased drastically. A more time-efficient HTML coding method was then used through the SAS community website (SAS Global Users Group Executive Board, 2010). The website produced the HTML style sheets and placed span elements throughout the HTML code, rather than typing it all out manually. Adjustments were then made to parts of the code where the program had not registered comments or had incorrectly assigned certain style elements. Comments at the beginning of each webpage describing the purpose of the section were still typed manually (see appendix Figure 10).

5 Discussion

Hospital discharge data provides several windows of information into the overall health of the nation over previous years. The NMDS was utilised within the EcHO project to ascertain patient quality of health care as a result of the increased expenditure into the industry. Healthcare quality was measured through patient indicators and throughput all developed in SAS code. These indicators ranged from avoidable hospitalisations through to avoidable mortality. Throughput was estimated in creating variables recording the average number of utilised beds and length of stay.

The NMDS is known to be widely used for research purposes in both the health sector and academia (Katzenellenbogen, et al., 2001b). Hospital discharge data provides key information into the health status of the country as provided by both

public and private hospitals. This information aids policy development and subsequent investment allocation of health resources and patient care (Poole, et al., 2009). While primarily an administrative data set, the NMDS is affected by ongoing corrections to disease classification and procedure coding (The New Zealand Children's Social Health Monitor, 2011). Additional to this is the creation of new diagnostic categories that may cause a significant shift in reported hospitalisations. These problems emphasise the importance of filtering when wanting to produce reliable and valid analyses on a data set such as the NMDS. Filtering attempts to remove the effects of the newly created categories in an effort to enable the researcher to reliably compare results over the years of data collection (Katzenellenbogen, et al., 2001a). The Ministry of Health (MoH) has released a series of steps that are performed on the NMDS to allow for valid comparisons and from these descriptions code was written to replicate the underlying conditions.

While several of the categories performed well and excluded a similar number of cases when compared to the MoH figures, some of them such as the error DRGs, ERCPs, inconsistent stays, mental health, and disability support service cases did not consistently exclude the similar cases. In particular the inconsistent stays category was problematic but showed to be in disagreement even within the released MoH hospital throughput publications (Ministry of Health, 2004a, 2004b, 2006a, 2006b). The data used from the NMDS also spanned a longer interval than the figures stated in the MoH publications as MoH figures ceased after the financial year of 2004/2005.

A key area of this project was on uploading the filtering code to the NZSSDS website. The NZSSDS plays a vital role in providing researchers access to methods and surveys conducted by trusted professionals. Allowing methods to be accessible enables collaboration and the right to use the programming code developed for commonly applied data sets will mean both time and resources will also be saved.

HTML code was used to publish the MoH filtering steps, accompanying code and descriptions along with the patient healthcare indicators on the NZSSDS. With the code and methods now available online, external researchers have the option of

forming an alliance with tried and tested work and contributing to its coverage and accuracy.

Limitations

A few limitations exist with the work conducted as part of this project. Firstly and quite importantly were the inconsistencies raised in several of the same categories in the MoH hospital throughput publications (Table 3). While small changes would be acceptable, due to the fact that when the filtering is conducted the data set is effectively frozen and any additional cases found post analysis will slightly change these figures, large discrepancies were discovered. In particular, inconsistent stays appeared to be in disagreement with itself when comparing the 01/02 and 02/03 with 03/04 and 04/05 hospital throughput publications. These discrepancies can place doubt upon what figures to rely on when comparing exclusions by category.

Attention must also be paid to the lack of a step 18 in the developed SAS code. Transfers account for around 20,000 exclusions every year. In-house discussion regarding the transfers category resulted in the idea that the cases were actually removed prior to any filtering done.

Another problematic category that was observed was step 16, mental health cases. The figure given for the financial year 2004/2005 was 17,228, a jump from the previous financial year 2003/2004 of 10,584 and earlier released figures of 10,661, 10,551 for the years 2002/2003 and 2001/2002, respectively (Table 1). This is a large increase for one year and instils doubt in the released hospital throughput publications.

A limitation of the HTML coding performed for the NZSSDS website is that the SAS code syntax highlighting involves constantly changing styles which can become laborious for a novice programmer. Although a SAS support website was found to apply the styles at the appropriate code segments, errors were still produced that required correction throughout the HTML code. The method therefore is not without errors so needs close inspection and concerted patience.

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Appendix

Figure 2 – Enhancing Hospital Outcomes: Introduction to the Enhancing Hospital Outcomes Section of the New Zealand Social Science Data Service Website.

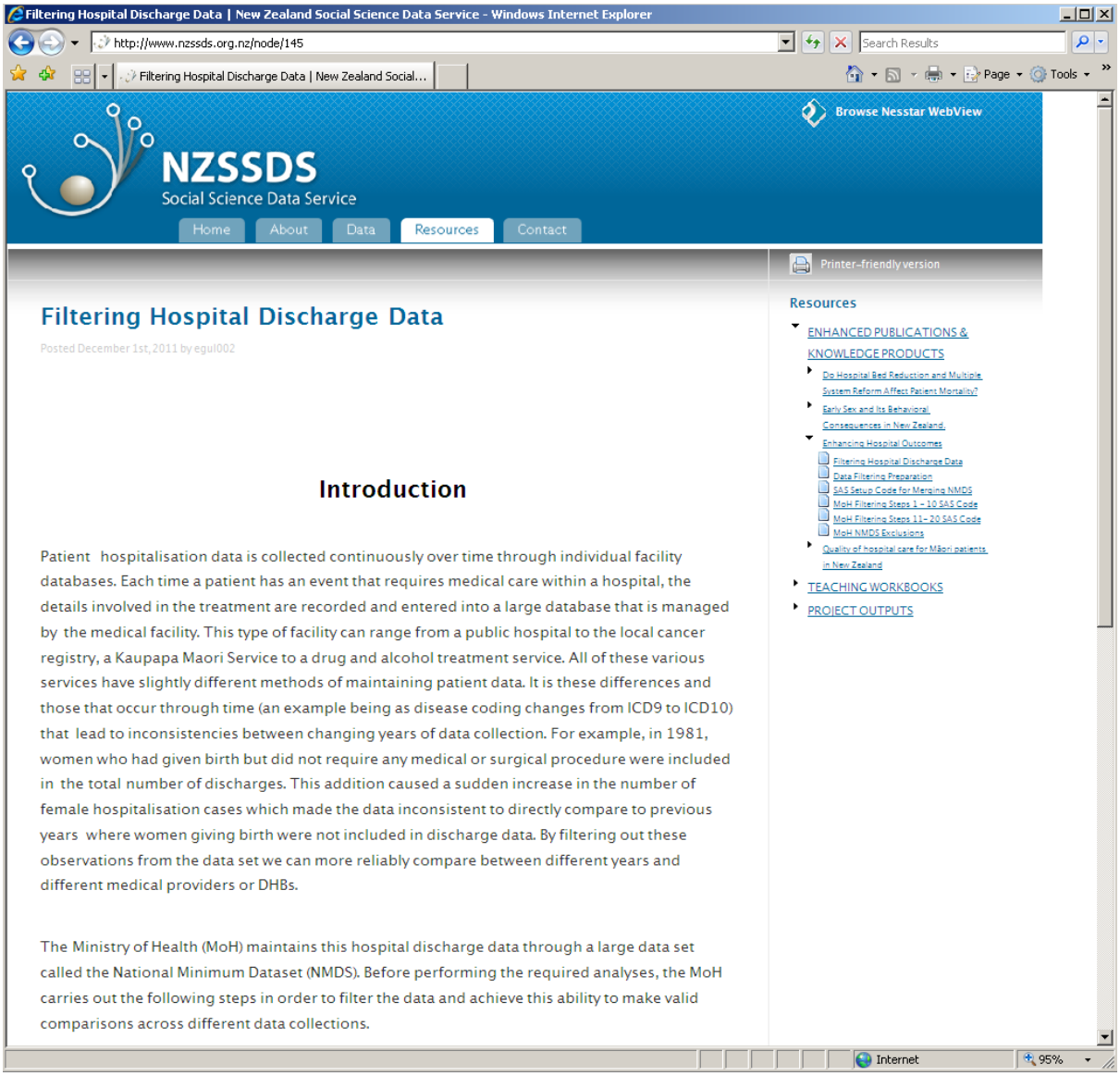

Figure 3 – Filtering Hospital Discharge Data: Introduction to the summer project and hospitalisation data.

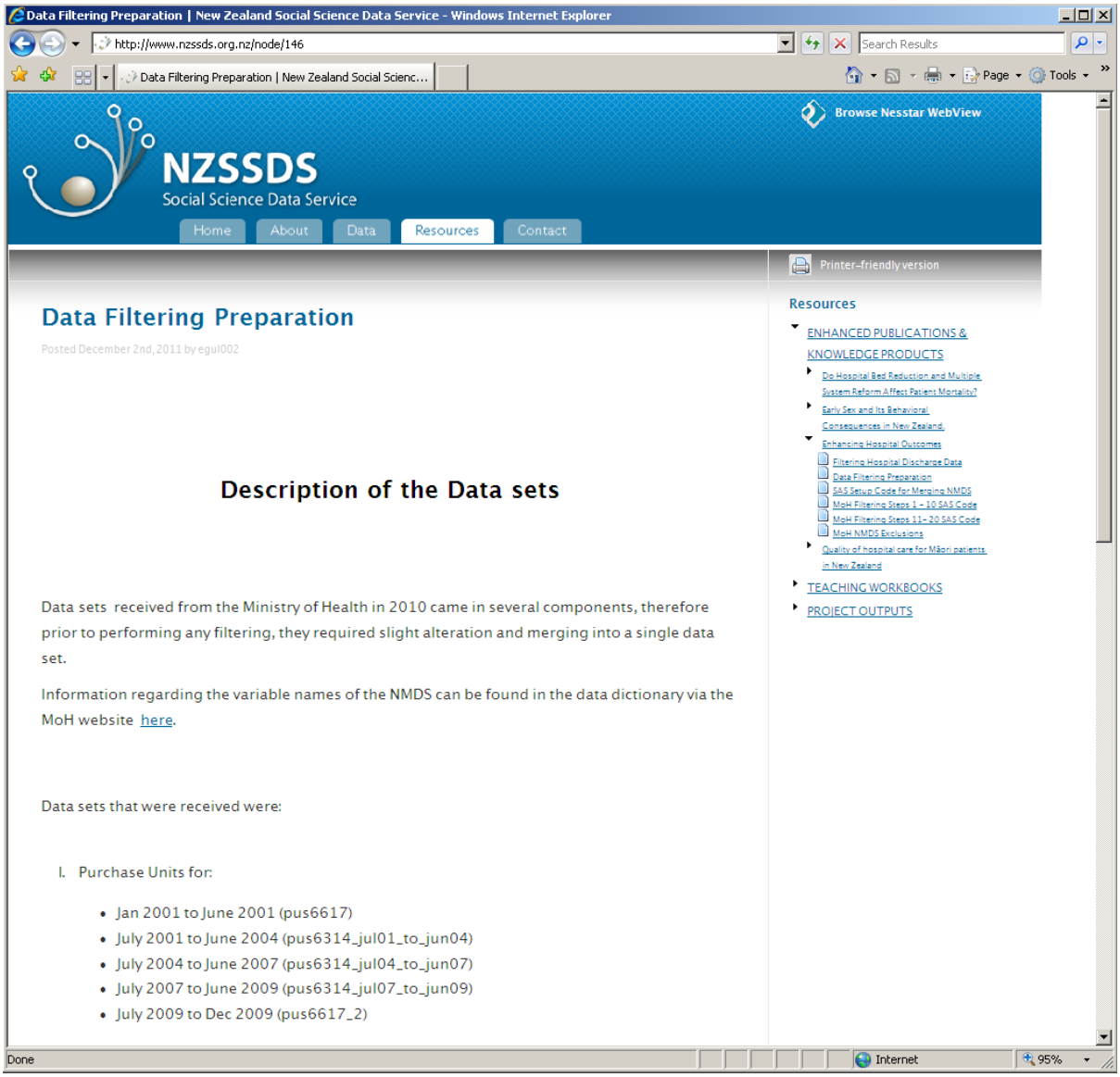

Figure 4 – Data Filtering Preparation: Description of each data set received from the MoH.

Figure 5 – SAS Setup Code: This page describes the methods of combining the different data sets from the previous page.

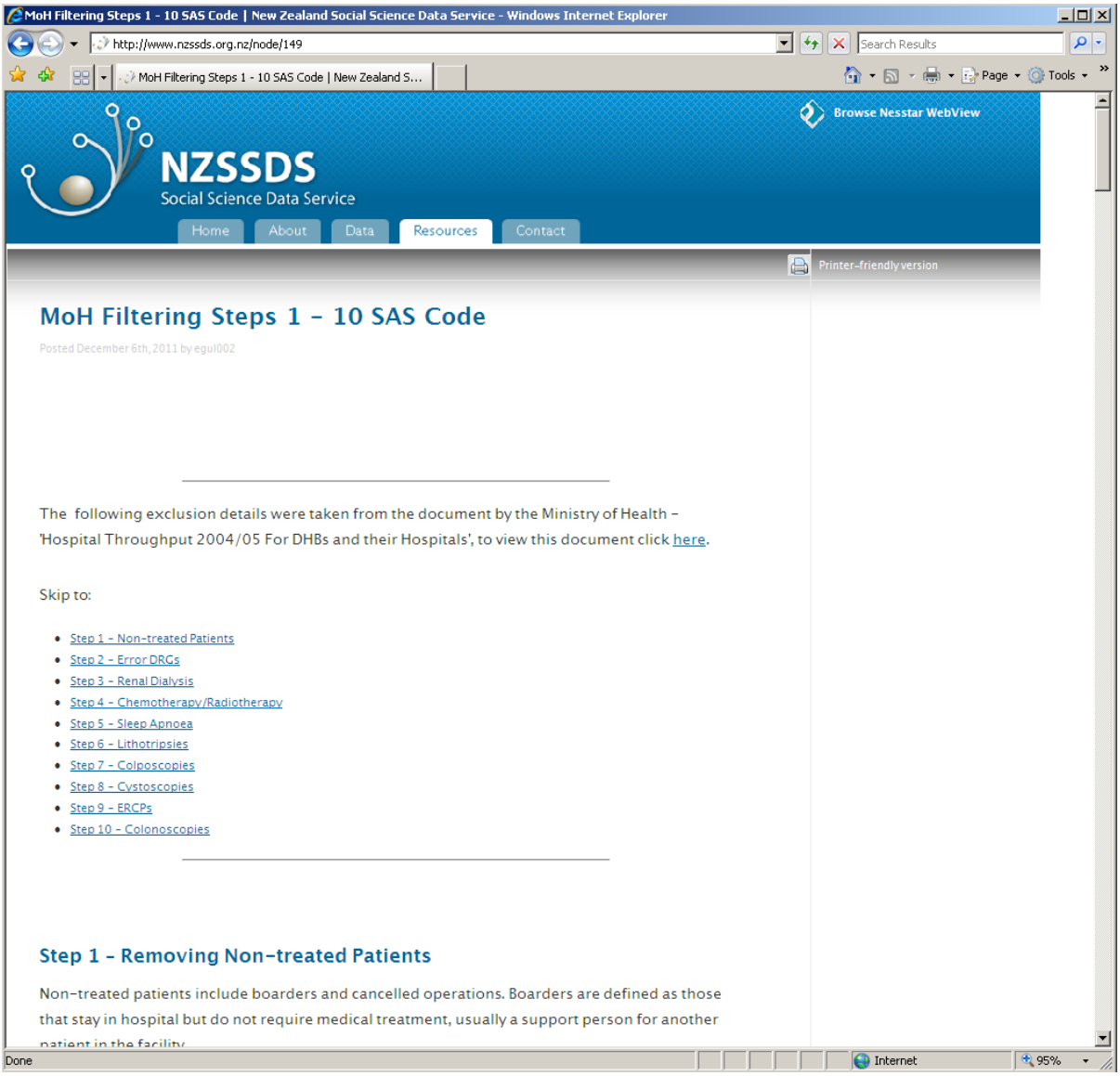

Figure 6 – MoH Filtering Steps SAS Code: This page shows the beginning of the descriptions to the MoH filtering steps 1 to 10.

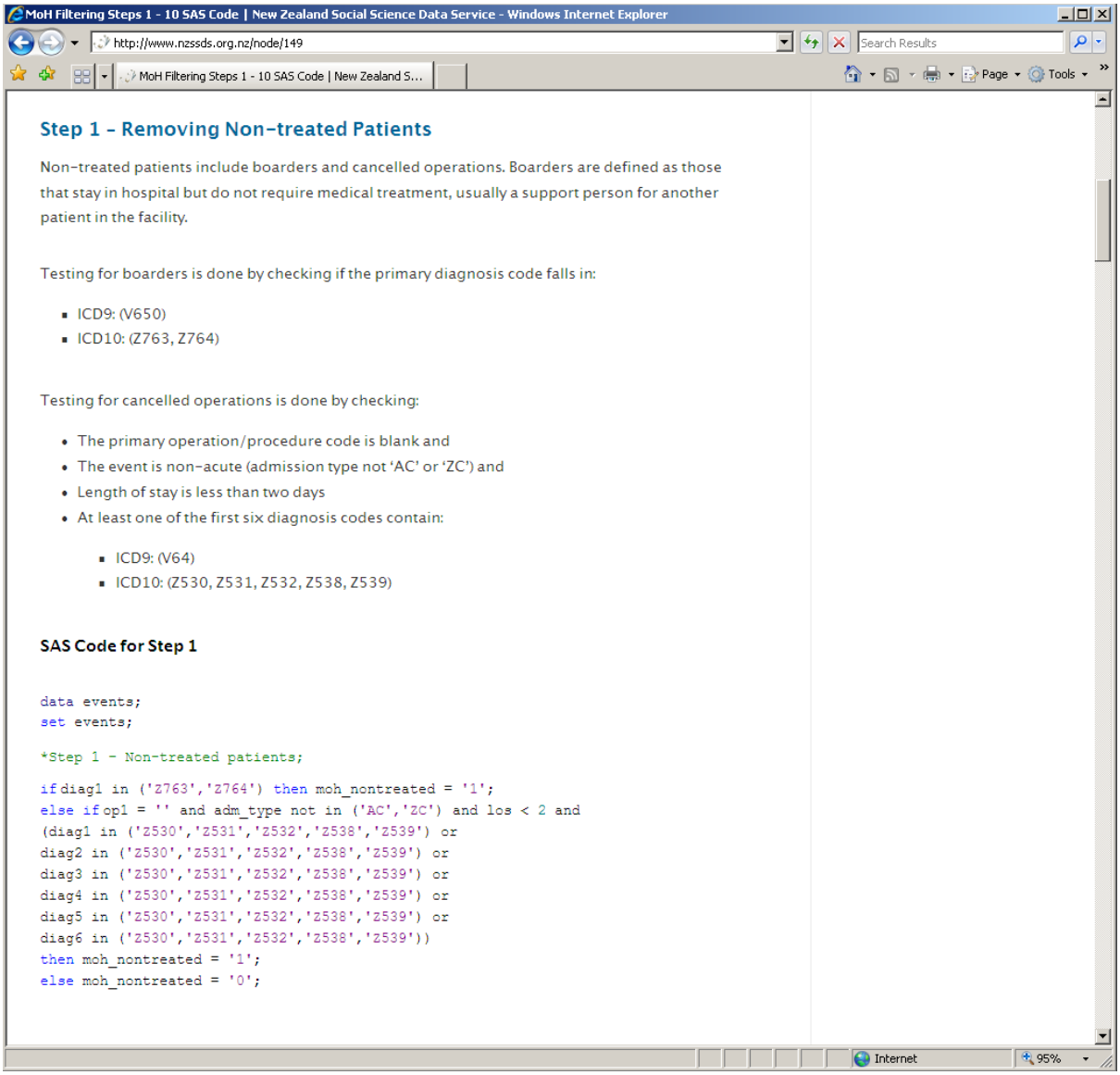

Figure 7 – Description and SAS code for step 1 of the 20 filtering steps.

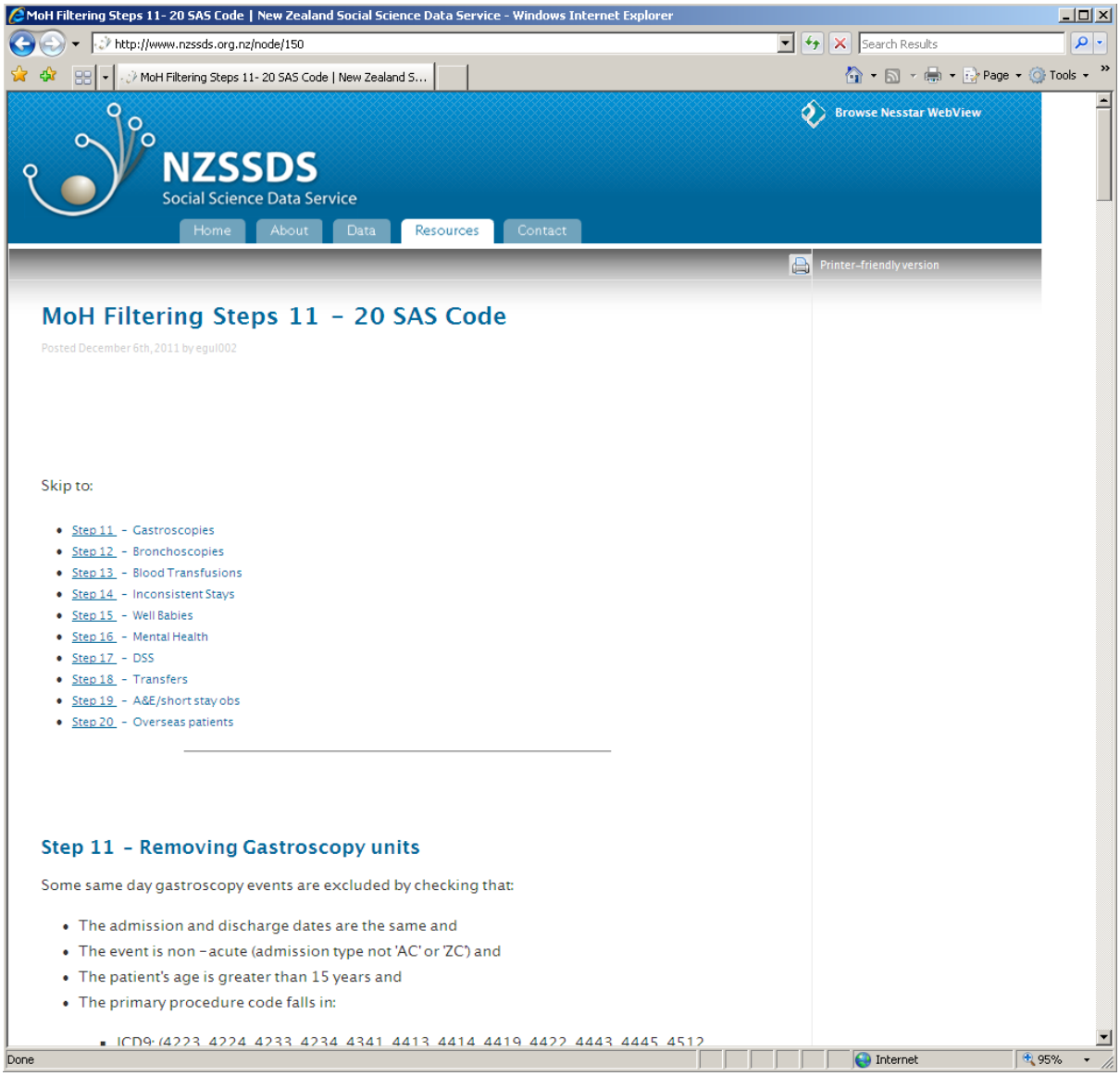

Figure 8 – MoH Filtering SAS Code: This page shows the second 10 steps of the MoH filtering.

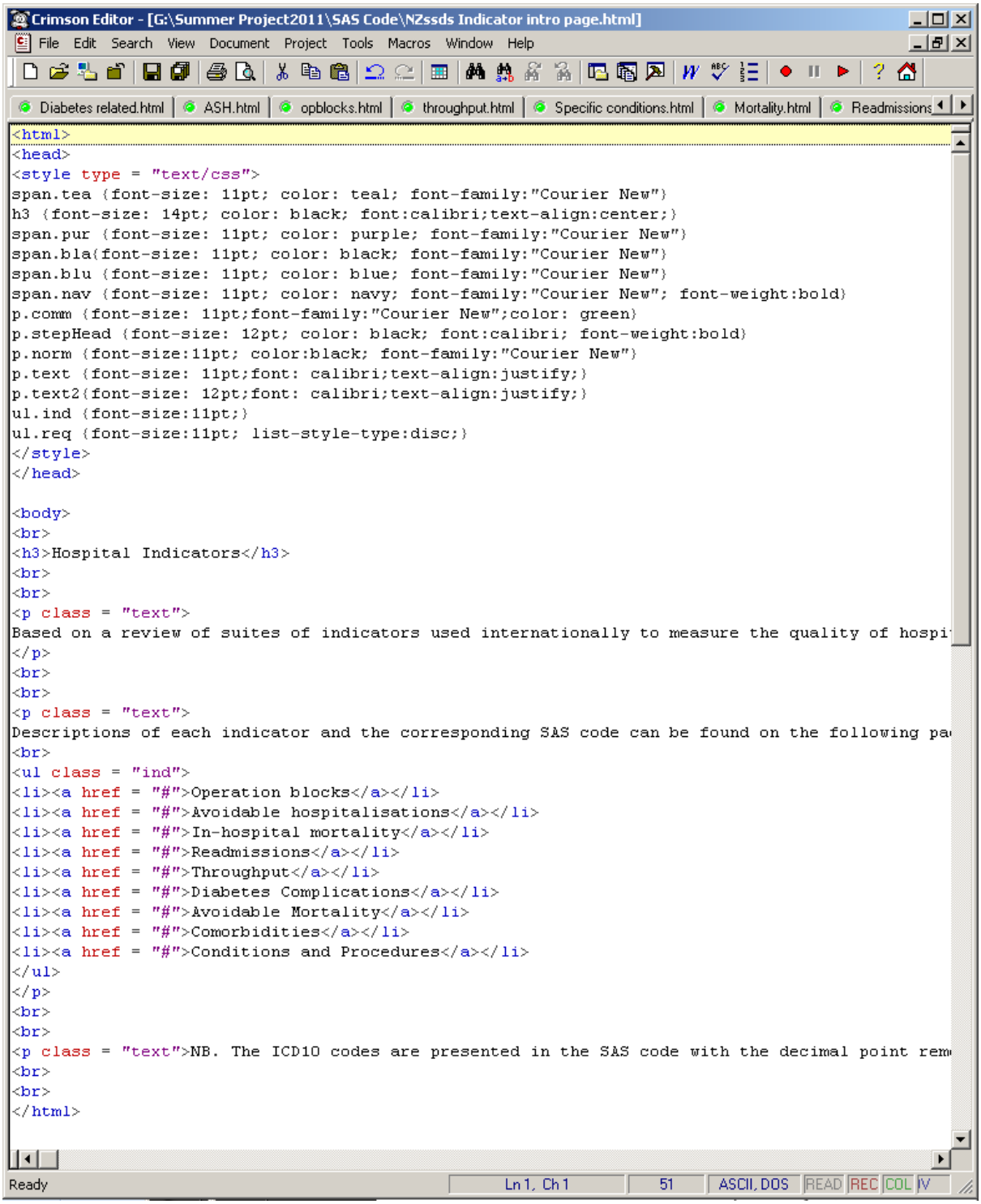

Figure 9 – HTML Code for the web page introducing the EcHO indicators. The style sheet is within the <style> and </style> tags.

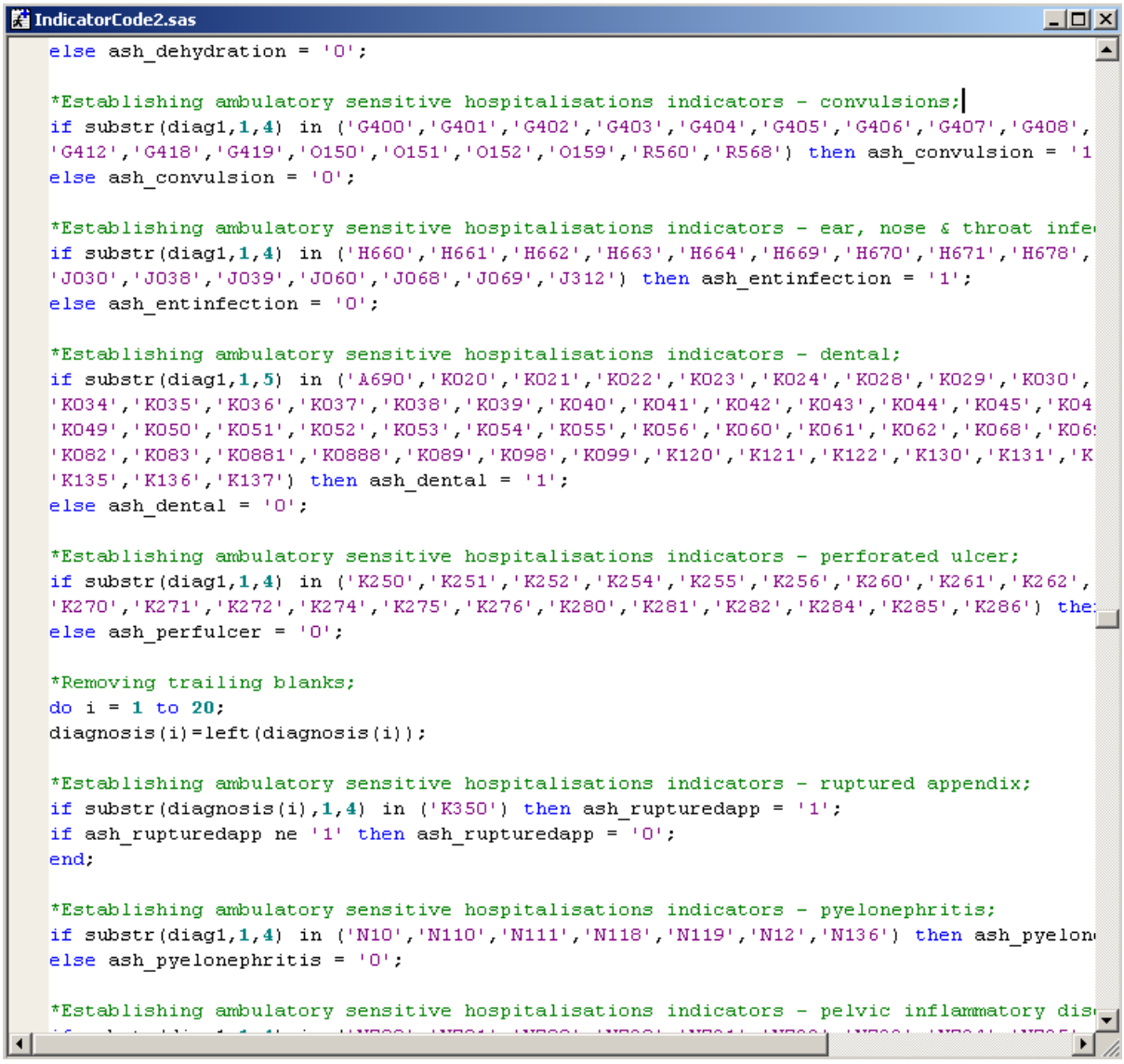

Figure 10 – SAS Code Commenting: Comments following the asterisk (*) and ending with a semi-colon (;) were not always recognised in the Syntax highlighting online program.

Figure 11 – Web page introducing the indicators and SAS code.

Figure 12 – Web page for the specific conditions ICD codes.

Figure 13 – Web page introducing the Op blocks and SAS code.

Figure 14 – Web page introducing the throughput calculation and SAS code.

Figure 15 – Web page discussing avoidable mortality and SAS code.

Figure 16 – Web page discussing avoidable hospitalisations and SAS code.

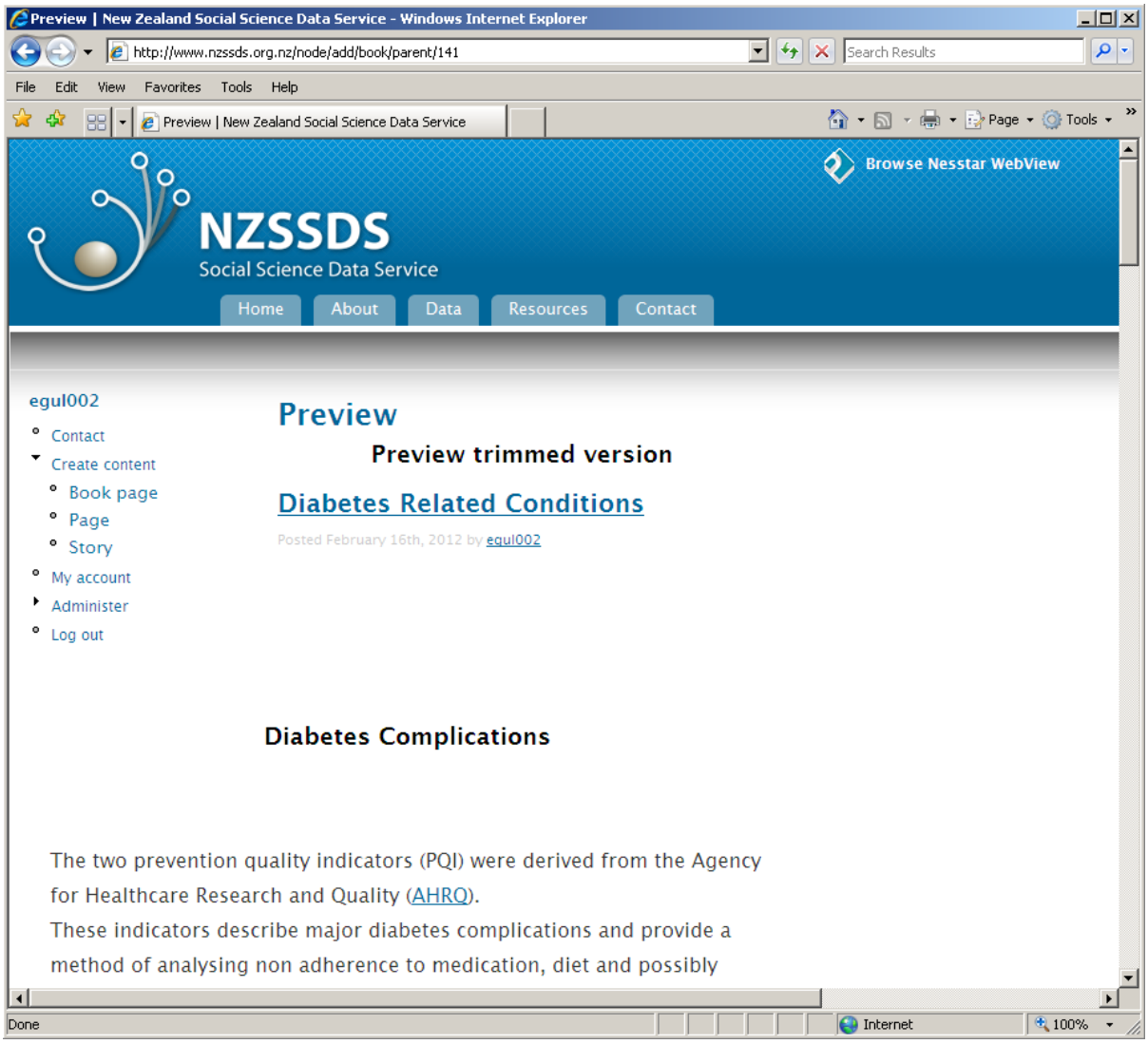

Figure 17 – Web page discussing the diabetes complications and SAS code.

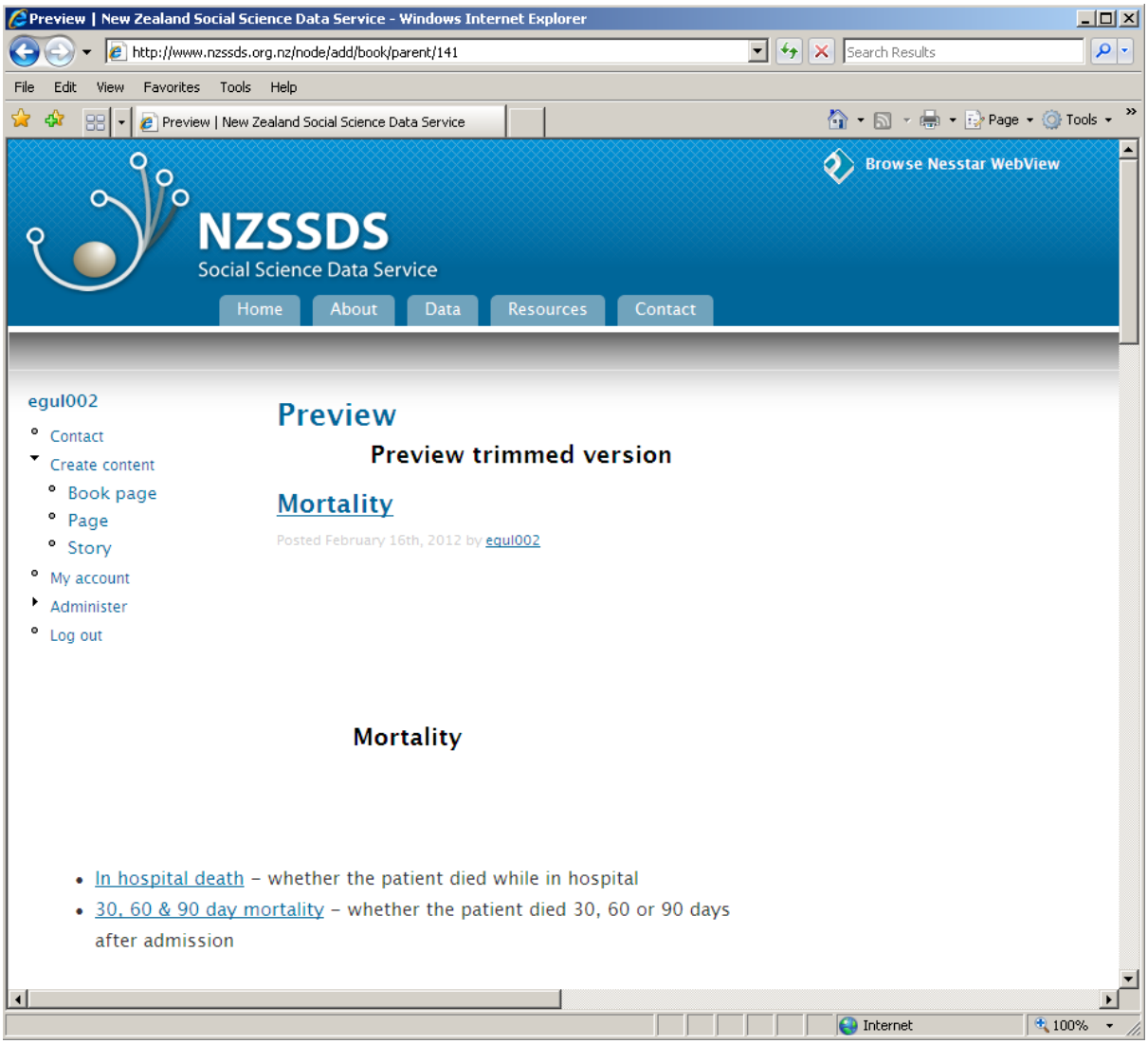

Figure 18 – Web page discussing mortality variables and SAS code.

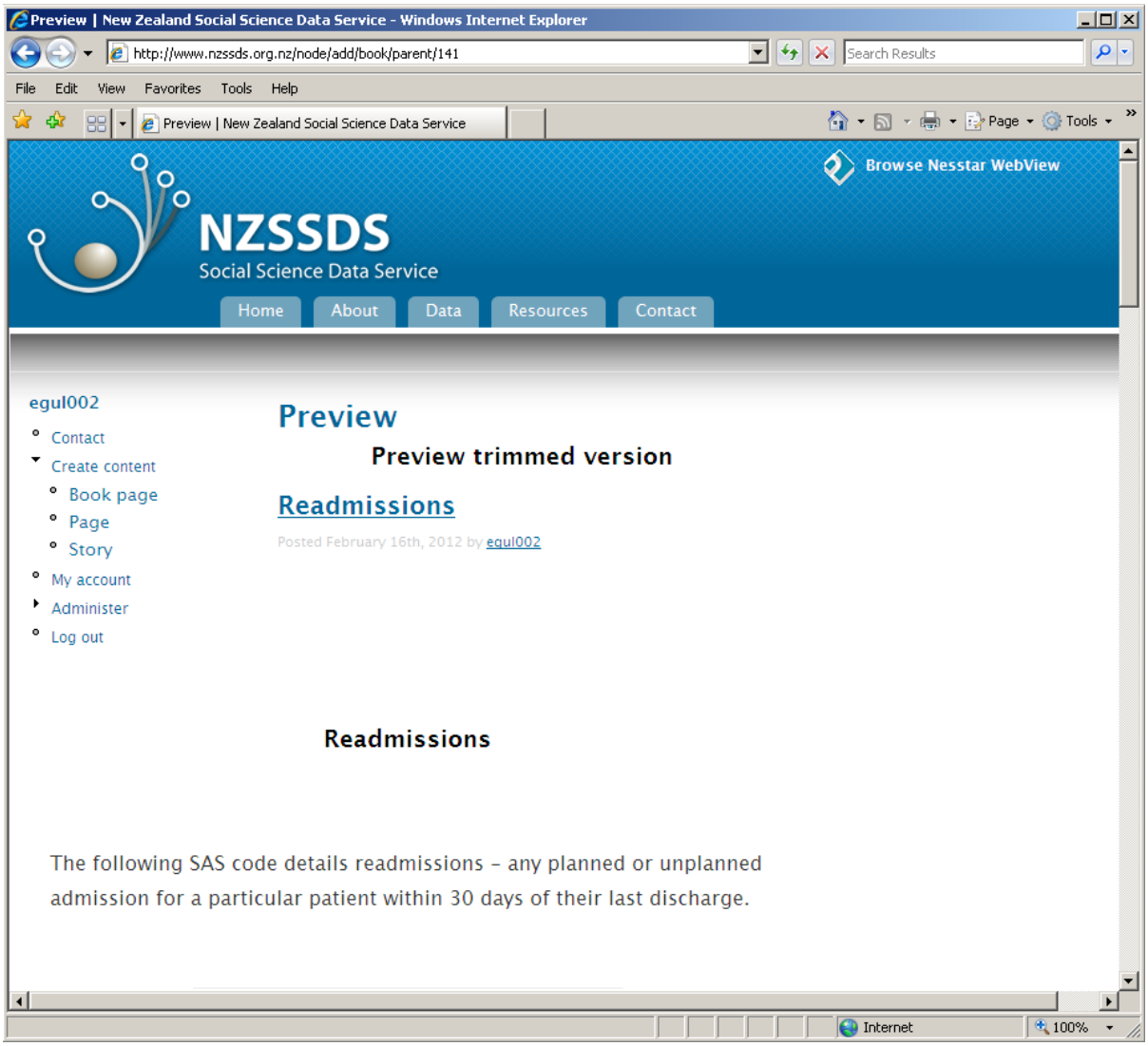

Figure 19 – Web page discussing readmissions and SAS code.