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CIHI Data Quality Study of the 2006–2007 Discharge Abstract Database

DAD




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About CIHI

The Canadian Institute for Health Information (CIHI) collects and analyzes information on health and health care in Canada and makes it publicly available. Canada's federal, provincial and territorial governments created CIHI as a not-for-profit, independent organization dedicated to forging a common approach to Canadian health information. CIHI's goal: to provide timely, accurate and comparable information. CIHI's data and reports inform health policies, support the effective delivery of health services and raise awareness among Canadians of the factors that contribute to good health.

Data and information quality is intrinsic to CIHI's mandate to inform public policy, support health care management and build public awareness about the factors that affect health. CIHI implements a complete data quality program that includes processes and policies to continuously improve data quality both within CIHI and in the broader health sector.

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- The 11 Health Information Management professionals who collected the data;
- The 32 hospitals across Canada that participated in this study and that welcomed the reabstractors into their sites;
- The Canadian Health Information Management Association, which assisted with advertising for reabstractors; and
- The provincial ministries of health and regional health authorities that supported this data quality initiative within their province.

Please note that the findings and recommendations outlined in the present document do not necessarily reflect the views of the individuals or organizations mentioned above.

Executive Summary

As part of its comprehensive data quality program, CIHI conducts a variety of data quality analyses and studies on its data holdings, including a systematic program of reabstraction for its Discharge Abstract Database (DAD). This report summarizes the results of a reabstraction study carried out on 2006–2007 data submitted to DAD. Specific objectives for this study included:

- An evaluation of the quality of health intervention data from Ontario, Alberta and B.C., which is used by CIHI's acute care grouping methodology, CMG+; and
- An assessment of the overall quality of coding clinical and non-clinical information in Ontario and the impact of any observed coding variations on measures of hospital outputs and resource indicators, as measured by the CMG+ grouping methodology.

The study also focused on identifying the underlying coding issues that might affect the quality of the data noted above and articulating considerations for improving data quality to address these.

Overall Quality of Intervention Data in Ontario, Alberta and British Columbia

The study findings support that the DAD data is fit for use with respect to the intervention data studied.

- Most flagged interventions were well represented in DAD in terms of reliability and completeness. Some flagged interventions, such as vascular access device in Ontario and pleurocentesis in Alberta, were under-reported to DAD. Some over-reporting of tracheostomy was observed in Ontario and B.C.
- Hospitalizations where there were discrepancies in the number of intervention events tended to be more complicated hospitalizations (that is, those cases with longer stays, more diagnoses and more interventions).
- There was complete and accurate reporting of out-of-hospital interventions.

Overall Quality of DAD Data in Ontario

- Ontario saw a statistically significant *increase* in total Resource Intensity Weight upon reabstraction. No hospital had a (statistically significant) decrease in total Resource Intensity Weight upon reabstraction, a reversal of results seen in previous Ontario DAD studies and a sign of improved adherence to coding standards.
- Significant improvement was noted in the reliability and completeness of the diagnosis and intervention data to DAD by acute care facilities in Ontario, in comparison with the results observed in 2005–2006.
- Hospital output measures and related resource indicators did not change substantially, whether they were derived using the original DAD data or the data obtained from the chart review.

Coding Issues[i]

While the study found high precision in the clinical data described in DAD, a number of discrepancies were found between the content of the original DAD data and the data documented in patient charts.

- Under- and over-reporting of diagnoses and interventions continued to be the area where most discrepancies were noted. These issues stemmed from difficulties in locating or accurately interpreting critical information documented in the patient chart, as well as applying some of CIHI's coding directives.
- In general, the coding of diagnoses and interventions was of high quality. Also, the selection of conditions that have an impact on the patient's overall length of stay or resource utilization was more reliable than in the previous reporting period, although there remains room for improvement. Chart documentation sometimes did not support the selection and typing of some of these conditions as comorbidities.
- Coding accuracy for the patient's most responsible diagnosis improved since 2005–2006, although it remained relatively low. This illustrates the multiplicative effect of inconsistencies in diagnosis type selection and coding, as well as additional data quality issues stemming from the completeness of reporting diagnostic details to DAD.

Considerations for Improving Coding Quality

The report indicates that enhancing the information and data quality of DAD is a shared responsibility between the health care professionals at the facilities who treat the patients and document their care, coders who extract patient information and record data on the DAD abstract, and those who maintain the DAD database and develop national coding directives. The findings from this study will be used to improve CIHI products, such as the CMG+ grouping methodology. Administrators, physicians and health records staff at the study hospitals can review the findings from this study found in their facility-specific report to identify areas where improvements are needed to promote high-quality DAD data.

For More Information

The enclosed report provides detailed information on the coding quality of DAD. For more information, beyond that presented herein, please write to dataquality@cihi.ca.

i. The coding issues detailed apply to Ontario only.

1 Introduction

1.1 The Discharge Abstract Database

The Discharge Abstract Database (DAD) is a national database that contains demographic, administrative and clinical data on acute care institution separations (discharges, deaths, sign-outs, transfers) across Canada. DAD was originally developed in 1963 to collect data on institution separations in Ontario. Over time, it has expanded to provide national coverage (with the exception of Quebec).

Information from DAD is used by institutions to support institution-specific utilization management decisions and administrative research. Governments use the data for funding and system planning and evaluation. Universities and other academic institutions use the data for various research purposes.[1]

In 2006–2007, CIHI received inpatient data from 633 acute care facilities from nine provinces and three territories, as illustrated in Table 1.

Table 1 Volume of Abstracts Submitted to DAD in 2006–2007, by Province/Territory

Province	Number of Acute Care Facilities	Number of Inpatient Abstracts
Newfoundland and Labrador	34	58,507
Prince Edward Island	7	16,569
Nova Scotia	34	93,303
New Brunswick	23	97,533
Quebec*	--	--
Ontario	171	1,090,042
Manitoba	96	137,172
Saskatchewan	70	138,538
Alberta	109	356,373
B.C.	83	401,277
Yukon	4	5,817
Northwest Territories	1	1,917
Nunavut	1	3,197
Total	**633**	**2,400,245**

Note

* Inpatient data from Quebec is submitted to CIHI's Hospital Morbidity Database.

1.2 Purpose of Case-Mix Grouping Methodologies

Case-mix grouping methodologies are used to cluster patient visits and encounters into groups of cases that are similar both clinically and with respect to resource use, therefore relating the types of patients a hospital treats to the resources utilized by the hospital. These methodologies were initially developed for use in comparing variations in treatment practices across hospitals. Grouping methodologies are now used by hospitals, regions and ministries of health for a variety of purposes, including clinical management, standardized comparison of hospital activity, hospital budgeting, monitoring, program planning and hospital funding.[2]

1.3 Study Overview, Rationale and Objectives

The main goal of this study is to assess the coding quality of intervention data from Ontario, Alberta and B.C. included in CIHI's inpatient grouping methodology, CMG+.[3] The study also included an overall coding quality assessment for data submitted from Ontario.

Specifically, the objectives of this study are the following:

- Evaluate the quality of intervention data from Ontario, Alberta and B.C. used by the CMG+ grouping methodology.
- Evaluate the overall quality of coding and abstracting of clinical and non-clinical information at acute care facilities *in Ontario*.
- Assess the impact of any observed coding variation in Ontario on measures of hospital output and resource utilization derived from CIHI's case-mix grouping methodology.
- Identify coding issues that arise as a result of any observed coding variation.

Data collected for this study required Health Information Management professionals (that is, hospital health record coders) to perform a chart review and abstract data that was then compared with DAD in a process called reabstraction. The coders who collected the data in this study are referred to as reabstractors throughout this report. The purpose of reabstraction is to identify systemic problems in coding. Coding problems could result from many areas, such as the following:

- Unclear directives in the *DAD Abstracting Manual*, CIHI's Canadian Coding Standards or the electronic books for the International Classification of Diseases and Health-Related Problems, Tenth Revision, Canada (ICD-10-CA) and the Canadian Classification of Health Interventions (CCI), which make it difficult for the coders to implement these standards and directives consistently;
- Coders' non-compliance with these directives for any number of reasons, which affects the data;
- Hospital policies that unintentionally negatively impact the quality of the data;
- The quality and completeness of the chart documentation, which affects the coders' ability to interpret the patient's stay with respect to the coding standards; and
- Invariably, unintentional human error introduced during the abstracting and coding process.

Reabstraction studies enable CIHI to determine the extent of coding inconsistency and also isolate the areas that are causing inconsistencies. The intent of these studies is not to find fault with either the hospital coder or the reabstractor, but to identify areas where the inconsistencies noted between these coders result in data quality issues. These studies provide CIHI with the information needed to improve its products and to engage in discussion with its stakeholders.

1.4 Privacy, Confidentiality and Security

CIHI policies on privacy, confidentiality and security, with respect to personal privacy and safeguarding the confidentiality of individual records and facilities, were adhered to throughout the course of the study. Information on CIHI policies for privacy and data protection can be found online at www.cihi.ca/privacy.

1.5 Objectives of This Report

This report presents the results of the 2006–2007 DAD data quality study. It focuses on intervention data used by the CMG+ 2009 grouping methodology.

This report contains eight chapters. This present chapter provides an introduction to the study. Chapter 2 presents the study method. The subsequent four chapters address the study objectives: Chapter 3 evaluates the coding quality of intervention data used in the CMG+ grouping methodology; chapters 4 and 5 discuss the coding quality of data from Ontario and assess the impact of coding variation on measures of hospital output and resource utilization; Chapter 6 discusses the coding issues identified in this study. The penultimate chapter summarizes the key findings and observations, and the final chapter provides references to papers used in this research.

2 Study Method

This study was designed to compare data originally captured on the inpatient abstract and reported to DAD to the information documented in the patient chart.

2.1 Study Design

The primary interest for this study was the coding of abstracts for patients who had been treated with select interventions or had their interventions performed at a different hospital from where they were being treated (referred to as *out-of-hospital interventions*). In addition, the study was restricted to the three provinces reporting DAD data that also report case-cost data: Ontario, Alberta and B.C. In Ontario, there was additional interest in the reliability of comorbidity levels[ii] assigned to abstracts by the grouping methodology. As a result, the target population for this study included only Ontario, Alberta and B.C. and was different in Ontario than in the other two provinces.

Of all acute care facilities that submit to DAD in these three provinces, 32 were selected. Facilities in Alberta and B.C. that submitted fewer than 1,000 abstracts to DAD in 2006–2007 or fewer than 100 abstracts with a flagged intervention[iii] were not considered for random sampling. In Ontario, all facilities were considered for random sampling. For facilities sampled, abstracts were selected based on the interventions present on the abstract.[iv] For Ontario, records were also selected based upon their comorbidity level; abstracts that were not in one of the intervention strata and that were assigned to a comorbidity level between "0" and "4" were also considered for random sampling.[v]

This sampling design reduced the scope of the study from 1,090,042 to 929,792 abstracts (85.3%) in Ontario, from 356,373 to 93,771 abstracts (26.3%) in Alberta and from 401,277 to 112,971 abstracts (28.2%) in B.C. In other words, the Ontario portion of the study was generally representative of the province of Ontario as a whole, while the Alberta and B.C. portions were representative of intervention cases in those provinces.

ii. Comorbidity levels partition hospitalizations into mutually exclusive levels based on the cumulative percentage increase in patient cost associated with certain comorbidity codes.

iii. Flagged interventions are associated with higher resource consumption cases, although the interventions themselves may not be costly. For more information about flagged interventions, please refer to the CMG+ directory.[3, 4]

iv. The study design was based on the CMG+ 2007 definitions, the most recent inpatient grouping methodology available at the time of sample selection.[4] DAD abstracts were stratified based on the presence of a tracheostomy, long mechanical ventilation, short mechanical ventilation, dialysis, vascular access device, remaining flagged intervention, an intervention event or an out-of-hospital intervention. One stratum included abstracts from certain Case Mix Groups that had no flagged intervention. Abstracts with lengths of stay of more than 30 days were not considered for random sampling, with two exceptions: cases with flagged interventions of tracheostomy or long mechanical ventilation.

v. Abstracts assigned to comorbidity level 8 were not considered for random sampling.

2.2 Training and Data Collection

For the purpose of training reabstractors for data collection, certain guidelines were developed to ensure consistency and thoroughness in the review and interpretation of chart documentation. All guidelines created for this study were developed in consultation with the CIHI Classifications department, which is responsible for developing and maintaining the classifications for diagnoses and interventions in Canada (ICD-10-CA and CCI). Training focused on diagnosis typing and the coding directives that are significant to the case-mix grouping methodology. Prior to field collection, reabstractors were required to complete a coding test to assess their understanding of the study guidelines.

For data collection, reabstractors performed reviews of the information in the patient's chart regarding his or her hospital stay.[vi] Their findings were recorded using a CIHI software application. The application stored the reabstracted data and then revealed the data stored in DAD, noting wherever discrepancies existed between the DAD data and the study data. The reabstractor then reconciled data by recording a reason for each discrepancy or by entering a comment with additional pertinent information.

2.3 Data Processing and Analysis

Data collected for the study underwent two stages of processing. In the first stage, edit, validation and logic checks were performed on the data to ensure that the files were in the proper format and to identify missing and/or invalid data and inconsistencies in the data transmitted. Where needed, CIHI staff corrected the data manually. In the second stage of processing, study weights and bootstrap weights were applied to the sampled records. This allowed for representative estimation and variance estimation of the study data. Both stages of processing are critical to ensure accurate information in the study database.

Only weighted estimates for the reabstraction study are presented in this report. Therefore, the 4,925 abstracts that were studied represent the study's population of reference of 1,136,534 abstracts. As estimation is based on a sample taken from the population, many estimates presented include a 95% confidence interval to indicate the amount of sampling error.[vii] Variance estimates were generated using the bootstrap method.

All analysis that relates to the intervention data used by the case-mix grouping methodology, or that relates to its associated derived variables, are based on CMG+ 2009, the most recent inpatient grouping methodology available at the time of publication.[3]

Table 2 compares the characteristics of all acute care inpatient abstracts in DAD from Ontario, Alberta and B.C. with weighted estimates generated when using the study data. The table illustrates that the estimates for Alberta and B.C. represent a high proportion of hospitalizations with intervention data and a lower proportion of hospitalizations with comorbidity data only. Estimates for Ontario are more inclusive as they represent all

vi. Data collection took place from March to May 2008. The response rate for the study was 100% (for a total of 4,925 abstracts).

vii. The sample reviewed in this study is only one of many samples, using the same design and size, that could have been selected from the same population. Sampling error is a measure of the variability between all possible samples.

facilities in this province and include a broader spectrum of clinical data. *There are limitations to the analysis presented in this report due to the exclusion of certain abstracts from the scope of this study*. Some analyses, such as the coding quality of diagnoses and interventions in DAD, have been restricted to Ontario, since these results are representative of all patient hospitalizations for this province.

Table 2 Characteristics of Abstracts Submitted to DAD in 2006–2007

	Ontario		Alberta		B.C.	
	DAD Data	Study Estimate	DAD Data	Study Estimate	DAD Data	Study Estimate
N	1,090,042	929,792	356,373	93,771	401,277	112,971
Age in Years *Mean (Inter-Quartile Range)*	46 (25–72)	49 (31–70)	43 (22–67)	53 (38–71)	48 (27–72)	55 (43–73)
Hospitalizations With a Flagged Intervention Present *N (Percent)*	102,752 (9.4%)	98,902 (10.6%)	28,330 (7.9%)	16,746 (17.9%)	33,934 (8.5%)	19,963 (17.7%)
Hospitalizations With Two or More Intervention Events *N (Percent)*	13,018 (1.2%)	11,989 (1.3%)	5,137 (1.4%)	4,455 (4.8%)	5,381 (1.3%)	3,235 (2.9%)
Total Number of Out-of-Hospital Interventions* *N (Percent)*	10,095 (0.9%)	8,680 (0.9%)	3,544 (1.0%)	2,725 (2.9%)	4,707 (1.2%)	4,631 (4.1%)
Total Number of Comorbidities† *N (Mean)*	1,116,415 (1.0)	1,025,419 (1.1)	377,024 (1.1)	103,889 (1.1)	408,290 (1.0)	142,468 (1.3)

Notes

N: number in population.

* Includes all the out-of-hospital interventions listed in the *CMG+ Directory 2009*, irrespective of whether the case-mix grouping methodology adjusts for these interventions occurring out of hospital.

† Type 1 and 2 diagnoses only.

Agreement rates were calculated for various parameters. Data from this study was also analyzed using the analytical model shown in Table 3. Note that this model was also used to analyze flagged interventions, case-mix grouping output variables and other data elements of interest.

Table 3 Analytical Model

		Status of Heath Condition in the Study Data "Criterion Standard"	
		Present	Absent
Status of Health Condition in DAD	**Present**	A	B
	Absent	C	D

Sensitivity and **positive predictive value** are two statistics used throughout this report. These statistics describe the quality of a test that determines the presence or absence of some characteristic (here, a health condition) by comparing the results of the test with another categorization that is believed to be without error. This "perfect" categorization is often called the "gold standard" or "criterion standard."

> **Sensitivity**, $A \div (A + C) \times 100\%$**:** the percentage of true positives of all patients with a health condition in the study data.
>
> **Positive predictive value**, $A \div (A + B) \times 100\%$**:** the percentage of patients with a health condition in DAD who also have the health condition in the study data.

Ideally, the criterion standard indicates whether a health condition is truly present for a patient. In this study, the results obtained by the reabstractors are considered the criterion standard only for the purpose of calculating these statistics.[viii] It is important to note in this study that these statistics must be used with caution, as the study method used was a chart review of the documentation for the patient. Therefore, the reabstraction data is more of a reference standard than a gold standard, as this study does not capture charting errors that could occur when patient histories are taken, diagnoses are made and other clinical information is recorded in the chart.

viii. Data collected from reabstractors is not "perfect." Coding variation between reabstractors is known to exist and was assessed in a previous reabstraction study on DAD 2005–2006 data.[5]

3 Quality of Intervention Data Used by CMG+

This chapter focuses on the study's first objective*, to evaluate the quality of intervention data from Ontario, Alberta and British Columbia used by the CMG+ grouping methodology.*

The CMG+ grouping methodology is a redevelopment of the acute care inpatient Case Mix Groups and complexity overlay methodology (CMG/PIx). CMG+ maintains the logic and high-level business rules from its predecessor methodologies to assign patient records to major clinical categories and Case Mix Groups. However, following these assignments, CMG+ makes use of five factors in the derivation of Resource Intensity Weight and expected length of stay. The five factors applied to each hospitalization in a Case Mix Group consist of age category, comorbidity level, flagged intervention, intervention event and out-of-hospital intervention.[2]

This chapter focuses on the reliability of certain aspects of the intervention data used by the CMG+ 2009 grouping methodology.

3.1 Reliability of Flagged Interventions

Flagged interventions are a subset of CCI codes[ix] used to identify patients who are likely to consume significant resources; the interventions themselves are not necessarily costly. Flagged interventions are not used for Case Mix Group assignment. Rather, they are applied after Case Mix Group assignment and are factored into the Resource Intensity Weight and expected length of stay methodologies. The 16 categories for flagged interventions are:

- Feeding tubes (PEG)
- Vascular access device
- Tracheostomy
- Chemotherapy
- Paracentesis
- Heart resuscitation
- Cardioversion
- Pleurocentesis
- Dialysis
- Radiotherapy
- Mechanical ventilation ≥ 96 hours
- Mechanical ventilation <96 hours
- Cell saver
- Parenteral nutrition
- Non-invasive biopsy
- Per-orifice endoscopy

The volumes of hospitalizations containing these interventions are not high, but they are sufficiently dispersed across the major clinical categories and have been found to be strong indicators of high-cost patients. Table 4 details the volumes of hospitalizations containing flagged interventions reported to DAD and compares these with the volumes of hospitalizations where flagged interventions were identified during the chart review. Note that the volumes illustrated for Ontario are representative of all abstracts submitted to DAD from this province, while for Alberta and B.C. these volumes are representative of only those abstracts that remained in scope for this study. The volumes of these hospitalizations in the study data were slightly larger than the volumes contained in DAD in Ontario.

ix. See the *CMG+ Directory 2009* for the CCI codes associated with each of the flagged interventions studied.

Table 4 Number of Hospitalizations Containing a Flagged Intervention in DAD Compared With the Study Data*

	Volume (in Thousands)					
	Ontario		Alberta‡		B.C.‡	
	DAD Data	Study Data	DAD Data	Study Data	DAD Data	Study Data
Any Flagged Intervention	98.9	111.2§	16.7	17.1	20.0	21.7
Vascular Access Device	14.6	20.6	4.9	5.7§	5.2	6.2§
Tracheostomy	2.0	1.9	0.7	0.7	0.7	0.6
Pleurocentesis	6.3	6.0	1.6	2.2§	1.8	1.9
Dialysis	8.9	9.3§	2.0	2.0	2.8	3.0
Mechanical Ventilation ≥96 Hours	8.2	8.5	2.4	2.5	2.5	2.6
Mechanical Ventilation <96 Hours	20.1	20.5	6.1	6.2	7.2	7.8
Parenteral Nutrition	6.9	7.9§	2.1	2.4§	1.9	2.1§
Other†	55.9	67.7§	4.8	5.6	6.0	7.3

Notes

* The flagged intervention exclusion rules used by CMG+ were applied in this analysis.[3] Also, when an "in progress" flagged intervention was present but not coded on the DAD abstract, it was also not reabstracted. This was done to account for the lack of directives on how to code "in progress" interventions in 2006–2007.[6]

† There was insufficient sample to produce estimates for each flagged intervention. "Other" consists of feeding tubes, chemotherapy, paracentesis, heart resuscitation, cardioversion, radiotherapy, cell saver, non-invasive biopsy and per-orifice endoscopy.

‡ The estimates for Alberta and B.C. are not representative of the overall DAD; they are representative of the patient population that remained in scope based on the study design.

§ The difference in volumes between the DAD data and the study data was found to be statistically significant ($p<0.05$) when using the bootstrap method.

3.1.1 Completeness of Reporting Flagged Interventions

This section examines the completeness of DAD data by determining if all hospitalizations with a flagged intervention documented in the patient chart also had the flagged intervention included on the DAD abstract.

Table 5 presents the percentage of the hospitalizations where a flagged intervention was identified during the chart review that also had a flagged intervention on the DAD abstract. These percentages are known as *sensitivities*. Low sensitivity results, such as those found for vascular access device in Ontario and pleurocentesis in Alberta, indicate where flagged interventions are under-reported to DAD. Most flagged interventions were well represented in DAD in terms of completeness.

Table 5 Frequency That Flagged Interventions Found During the Chart Review Were Also Present in DAD, by Province*

	Sensitivity (95% CI)		
	Ontario	Alberta‡	B.C.‡
Vascular Access Device	**68** (47–90)§	**82** (76–87)	**82** (77–88)
Tracheostomy	**90** (77–100)	**95** (86–100)	**91** (76–100)
Pleurocentesis	**88** (80–96)	**67** (52–83)§	**91** (84–99)
Dialysis	**95** (91–99)	**100** (99–100)	**94** (88–99)
Mechanical Ventilation ≥96 Hours	**91** (87–96)	**89** (83–96)	**94** (90–98)
Mechanical Ventilation <96 Hours	**93** (91–96)	**96** (93–98)	**89** (76–100)
Parenteral Nutrition	**84** (77–92)	**87** (78–97)	**92** (85–98)
Other†	**80** (67–93)	**81** (63–99)§	**76** (51–100)§

Notes

CI: confidence interval.

* See Table 4 for the flagged interventions that were excluded from this analysis.

† There was insufficient sample to produce estimates for each flagged intervention. "Other" consists of feeding tubes, chemotherapy, paracentesis, heart resuscitation, cardioversion, radiotherapy, cell saver, non-invasive biopsy and per-orifice endoscopy.

‡ The estimates for Alberta and B.C. are not representative of the overall DAD; they are representative of the patient population that remained in scope based on the study design.

§ The high variances for these estimates arise from a small number of records that have large study design weights.

The specific CCI codes used to identify flagged interventions were studied to determine if particular codes were prone to under-reporting. Table 6 presents the combined results for all three studied provinces. The study generally found very complete reporting for CCI codes. For example, when flagged intervention 1.PZ.21—*Dialysis, Urinary System Not Elsewhere Classified* was reabstracted, it was also present in DAD as a flagged intervention and represented with the same CCI rubric 95% of the time. However, some flagged interventions, such 1.NF.53—*Implantation of Internal Device, Stomach* and 1.IS.53—*Implantation of Internal Device, Vena Cava (Superior and Inferior)* were under-reported, and these interventions were sometimes not represented at all in DAD for the patient hospitalization.

Table 6 Frequency That CCI Flagged Interventions Found During the Chart Review Were Also Present in DAD as a Flagged Intervention and Represented With the Same CCI Rubric*

	Sensitivity† (95% CI)
1.PZ.21—Dialysis, Urinary System NEC *(Dialysis)*	**95** (92–98)
1.GZ.31—Ventilation, Respiratory System NEC *(Mechanical Ventilation)*	**95** (93–98)
2.GM.70—Inspection, Bronchus *(Per-Orifice Endoscopy)*	**95** (90–99)
1.GJ.77—Bypass with Exteriorization, Trachea *(Tracheostomy)*	**91** (83–99)
1.OT.52—Drainage, Abdominal Cavity *(Paracentesis)*	**88** (82–94)
1.LZ.35—Pharmacotherapy (Local), Circulatory System NEC *(Parenteral Nutrition)*	**86** (81–92)
1.GV.52—Drainage, Pleura *(Pleurocentesis)*	**84** (78–90)
2.GM.71—Biopsy, Bronchus *(Non-Invasive Biopsy)*	**82** (61–100)
2.NK.70—Inspection, Small Intestine *(Per-Orifice Endoscopy)*	**81** (66–95)
1.NF.53—Implantation of Internal Device, Stomach *(Feeding Tube)*	**79** (66–93)
1.IS.53—Implantation of Internal Device, Vena Cava (Superior and Inferior) *(Vascular Access Devices)*	**73** (59–88)

Notes

CI: confidence interval; NEC: not elsewhere classified.

* See Table 4 for the flagged interventions that were excluded from this analysis. To be considered for this analysis, the study sample had to contain a minimum of 100 occurrences of the intervention in the reabstracted data.

† These estimates are not representative of the overall DAD; they are representative of the patient population that remained in scope based on the study design.

3.1.2 Correctness of Flagged Interventions Reported to DAD

This section examines the correctness of DAD data by determining how often documentation in the patient chart supports the inclusion of the flagged intervention found on the DAD abstract.

Table 7 presents the percentage of DAD abstracts containing a flagged intervention that had information located in the chart by the reabstractor that supported its inclusion on the DAD abstract. These percentages are known as *positive predictive values*. Most flagged interventions had very high positive predictive values, indicating minimal over-reporting to DAD. Some over-reporting of tracheostomy was observed in Ontario and B.C. and pleurocentesis in Ontario, as shown by the lower values.

Table 7 Frequency That Flagged Interventions Reported to DAD Were Confirmed During the Chart Review, by Province*

	Positive Predictive Value (95% CI)		
	Ontario	Alberta‡	B.C.‡
Vascular Access Device	**96** (93–99)	**93** (89–98)	**99** (99–100)
Tracheostomy	**82** (76–88)	**93** (88–99)	**78** (69–87)
Pleurocentesis	**84** (75–94)	**94** (86–100)	**95** (88–100)
Dialysis	**99** (98–100)	**98** (97–100)	**99** (97–100)
Mechanical Ventilation ≥96 Hours	**95** (92–98)	**91** (86–96)	**98** (95–100)
Mechanical Ventilation <96 Hours	**95** (92–98)	**97** (94–100)	**96** (94–99)
Parenteral Nutrition	**97** (93–100)	**100** (99–100)	**100** (100–100)
Other†	**97** (95–98)	**94** (90–98)	**94** (88–100)

Notes
CI: confidence interval.
* See Table 4 for the flagged interventions that were excluded from this analysis.
† There was insufficient sample to produce estimates for each flagged intervention. "Other" consists of feeding tubes, chemotherapy, paracentesis, heart resuscitation, cardioversion, radiotherapy, cell saver, non-invasive biopsy and per-orifice endoscopy.
‡ The estimates for Alberta and B.C. are not representative of the overall DAD; they are representative of the patient population that remained in scope based on the study design.

The specific CCI codes used to identify flagged interventions were studied to determine if particular codes were prone to over-reporting. Table 8 presents the combined results for all three provinces studied. The study generally found very reliable reporting for CCI codes, many of which were also found to be reported completely (Table 6). There were some exceptions. For example, 1.IS.53—*Implantation of Internal Device, Vena Cava (Superior and Inferior)* was found to be slightly under-reported, but the positive predictive value for this intervention supports that it is very reliable when coded on the abstract (that is, not over-reported). This analysis found that codes, 1.NF.53—*Implantation of Internal Device, Stomach*, 1.GJ.77—*Bypass with Exteriorization, Trachea* and 2.NK.70—*Inspection, Small Intestine* were over-reported to DAD. Reabstractors often confirmed that these procedures were performed but used a different CCI code to describe them. The reabstracted code was frequently not classified as a flagged intervention.

Table 8 Frequency That Flagged Interventions Reported to DAD Were Confirmed as a Flagged Intervention During the Chart Review Using the Same CCI Rubric*

	Positive Predictive Value† (95% CI)
1.PZ.21—Dialysis, Urinary System NEC *(Dialysis)*	**99** (98–100)
1.GZ.31—Ventilation, Respiratory System NEC *(Mechanical Ventilation)*	**98** (97–99)
1.OT.52—Drainage, Abdominal Cavity *(Paracentesis)*	**98** (95–100)
1.LZ.35—Pharmacotherapy (Local), Circulatory System NEC *(Parenteral Nutrition)*	**98** (95–100)
1.IS.53—Implantation of Internal Device, Vena Cava (Superior and Inferior) *(Vascular Access Devices)*	**96** (94–98)
2.GM.70—Inspection, Bronchus *(Per-Orifice Endoscopy)*	**96** (92–100)
1.GV.52—Drainage, Pleura *(Pleurocentesis)*	**88** (82–94)
1.NF.53—Implantation of Internal Device, Stomach *(Feeding Tube)*	**85** (76–95)
1.GJ.77—Bypass with Exteriorization, Trachea *(Tracheostomy)*	**84** (80–88)
2.NK.70—Inspection, Small Intestine *(Per-Orifice Endoscopy)*	**81** (54–100)

Notes

CI: confidence interval; NEC: not elsewhere classified.

* See Table 4 for the flagged interventions that were excluded from this analysis. To be considered for this analysis, the study sample had to contain a minimum of 100 occurrences of the intervention present in the DAD data.

† These estimates are not representative of the overall DAD; they are representative of the patient population that remained in scope based on the study design.

3.2 Reliability of Intervention Event

The resource utilization of patients admitted to the hospital who receive an intervention is largely accounted for in the assignment of these patients to a Case Mix Group in the intervention partition. However, some patients need to make multiple visits to the operating room or procedure suite during the same admission. Each of these visits is considered an intervention event if a significant intervention—that is, an intervention that would be considered for Case Mix Group assignment—is performed.

The greater the number of intervention events, the more costly the hospitalization. Hence, the number of intervention events provides additional explanation of resources used in treating a patient. Intervention events are factored into the assigned Resource Intensity Weight and expected length of stay resource indicators based on the occurrence of two, or three or more intervention events.[2]

Table 9 describes the number of intervention events for the abstracts studied. Note again that the volumes illustrated under the heading "DAD Data" for Ontario are representative of all abstracts submitted to DAD from this province, while for Alberta and B.C., these volumes are representative of only those abstracts that remained in scope for this study. Overall, the number of intervention events in the DAD data was similar to the number of intervention events coded by the reabstractor.

Table 9 Number of Intervention Events for Hospitalizations in DAD Compared With the Study Data

Number of Intervention Events	Volume (in Thousands)					
	Ontario		Alberta*		B.C.*	
	DAD Data	Study Data	DAD Data	Study Data	DAD Data	Study Data
None	662.7	661.0	11.3	12.8	12.7	13.1
One	255.1	256.5	78.0	74.0	97.0	96.1
Two	11.3	11.1	4.1	6.7	2.7	3.2
Three or More	0.7	1.1†	0.3	0.3	0.5	0.6

Notes

* The estimates for Alberta and B.C. are not representative of the overall DAD; they are representative of the patient population that remained in scope based on the study design.

† The difference in volumes between the DAD data and the study data was found to be statistically significant ($p < 0.05$) when using the bootstrap method.

Table 10 presents the agreement rates for intervention event and combines the results for all three provinces studied. Hospitalizations with one or no intervention event present in DAD were very reliable. Ninety-nine percent of the hospitalizations with no intervention event in the DAD data were similarly coded by the reabstractor as having no intervention event. The same was true for 98% of the hospitalizations where there was one intervention event. The few hospitalizations that had two intervention events had a lower agreement rate of 78% and often had only one intervention event in the reabstracted data. That is, the study found that 20% of the abstracts with two intervention events in DAD had only one intervention event upon reabstraction. The lower agreement rates observed for cases with two or more intervention events were significantly lower ($p < 0.05$) than the agreement rate for cases with no intervention event. Changes to the number of intervention events occurred when there was a discrepancy in which interventions took place during the patient's hospital stay or when there was a discrepancy in the date certain interventions were performed.

Table 10 Agreement Rates on the Number of Intervention Events When Using DAD Data and Chart Review Data*

Number of Intervention Events in DAD	Volume in DAD (in Thousands)	Number of Intervention Events in Study Data			
		None	One	Two	Three or More
None	686.8	**99.3%**	0.4%	0.3%	0.0%
One	430.0	1.1%	**97.7%**	1.1%	0.0%
Two	18.1	0.0%	19.7%	**78.3%**	2.0%
Three or More	1.6	0.0%	1.0%	5.6%	**93.4%**

Note

* These estimates are not representative of the overall DAD; they are representative of the patient population that remained in scope based on the study design.

Analysis was performed on specific groupings of intervention codes to determine if certain procedures on the Intervention Partition CCI Code List were more prone to under- or over-reporting. This analysis yielded no significant findings due to insufficient sample sizes. However, certain types of hospitalizations were more prone to changes in the number of intervention events. Table 11 presents this analysis. In general, the hospitalizations where there were discrepancies in the number of intervention events tended to be more complicated hospitalizations (that is, those with longer lengths of stay, more diagnoses and more interventions).

Table 11 Characteristics of Hospitalizations Dependent Upon the Change in the Number of Intervention Events Found During the Chart Review*

	Fewer Intervention Events in Study Data	Same Number of Intervention Events in Study Data	More Intervention Events in Study Data
Number in Population, *in Thousands*	8.5	1,118.1	9.9
Hospital Mortality	3%	3%	7%
Length of Stay, *Median*	12 days	3 days	9 days
More than Three Diagnoses† **on the DAD Abstract**	58%	14%	35%
More than Three Interventions‡ **on the DAD Abstract**	35%	5%	14%

Notes

* These estimates are not representative of the overall DAD; they are representative of the patient population that remained in scope based on the study design.

† Considers the significant diagnosis codes only (types M, 1, 2, W, X, Y).

‡ Includes only those interventions that are mandatory to capture according to the 2006 Canadian Coding Standards and/or those that impact CMG+ assignment. Note that provincial variations in mandatory coding were not considered (for example, computed tomography [CT] scans are mandatory to capture in Ontario only).[6]

3.3 Reliability of Out-of-Hospital Intervention

Out-of-hospital interventions are interventions performed on a patient at a different hospital from the reporting hospital to which they were admitted. Where the interventions take place does not affect the assignment of Case Mix Group. However, the cost of performing the out-of-hospital intervention is not incurred to the (host) facility where the patient is admitted. CMG+ accounts for out-of-hospital interventions by adjusting the Resource Intensity Weight downward for the host facility while recognizing that the host facility still incurs costs for all the post-intervention care of the patient.[x] These adjustments are applied for select cardiac procedures only.[xi]

Table 12 presents the overall volumes of out-of-hospital interventions in the three provinces. The number of these interventions reported to DAD was similar to or the same as the number reabstracted during the chart review. There was complete and accurate reporting of out-of-hospital interventions, with only a few cases where out-of-hospital interventions were missing from the DAD abstract when it was documented as out of hospital in the patient chart.

Table 12 Out-of-Hospital Interventions in DAD Compared With the Study Data*

	Volume (in Thousands)					
	Ontario		Alberta†		B.C.†	
	DAD Data	Study Data	DAD Data	Study Data	DAD Data	Study Data
Out-of-Hospital Interventions	8.7	8.9	2.7	2.9‡	4.6	4.7

Notes

* Includes all the out-of-hospital interventions listed in the *CMG+ Directory 2009*, irrespective of whether the case-mix grouping methodology adjusts for these interventions occurring out of hospital.

† The estimates for Alberta and B.C. are not representative of the overall DAD; they are representative of the patient population that remained in scope based on the study design.

‡ The difference in volumes between the DAD data and the study data was found to be statistically significant ($p < 0.05$) when using the bootstrap method.

x. The expected length of stay for the patient is not affected by this factor in the CMG+ methodology.

xi. See the CMG+ Directory 2009 for the CCI codes associated with out-of-hospital interventions.

3.4 Summary of Findings for the Quality of Intervention Data Used by CMG+

Key findings from this chapter:

Flagged Intervention

- Most flagged interventions were well represented in DAD in terms of reliability and completeness.
- Some flagged interventions, such as vascular access device in Ontario and pleurocentesis in Alberta, were under-reported to DAD.
- Some over-reporting of tracheostomy was observed in Ontario and B.C.

Intervention Event

- Hospitalizations with one or no intervention event present in DAD were very reliable.
- In general, the hospitalizations where there were discrepancies in the number of intervention events tended to be more complicated hospitalizations (that is, those with longer lengths of stay, more diagnoses and more interventions).

Out-of-Hospital Intervention

- There was complete and accurate reporting of out-of-hospital interventions, with only a few cases where interventions were not coded as out of hospital on the DAD abstract when they were documented as out of hospital in the patient chart.

4 Quality of DAD Data for Ontario

This chapter focuses on the study's second objective, *to produce estimates of overall coding quality for Ontario*.

Coding quality can be defined in terms of completeness and correctness, where completeness represents the proportion of observations "about the world" that are actually recorded and correctness represents the proportion of observations that reflect the "true state of the world."[7] Both measurements are necessary to assess data accuracy. A high level of correctness may be achieved at the expense of failing to record all information. Similarly, a high level of completeness may be obtained at the cost of poor correctness.[8]

4.1 Completeness of Clinical Data in DAD

This section examines the completeness of DAD data reported from Ontario by determining if all associated diagnoses and interventions that were documented in the patient chart were also included on the DAD abstract.

4.1.1 Completeness of Reporting Diagnoses to DAD

Of all the significant diagnoses found during the chart review, 78% were reported on the DAD abstract as a significant diagnosis. This percentage is known as *sensitivity* (Table 13). This sensitivity result indicates potential under-reporting to DAD of 22% of the health conditions experienced in the inpatient setting that can impact the patient's length of stay or resource utilization.

Table 13 Diagnoses Captured During the Chart Review Compared With Data on the DAD Abstract, Ontario Results

	DAD Data (in Thousands)		Total in Study Data (in Thousands)	Sensitivity (95% CI)
	Present	Absent		
All Significant Diagnoses in Study Data*	1,623.7	452.0†	2,075.6	**78.2** (75.7–80.7)

Notes

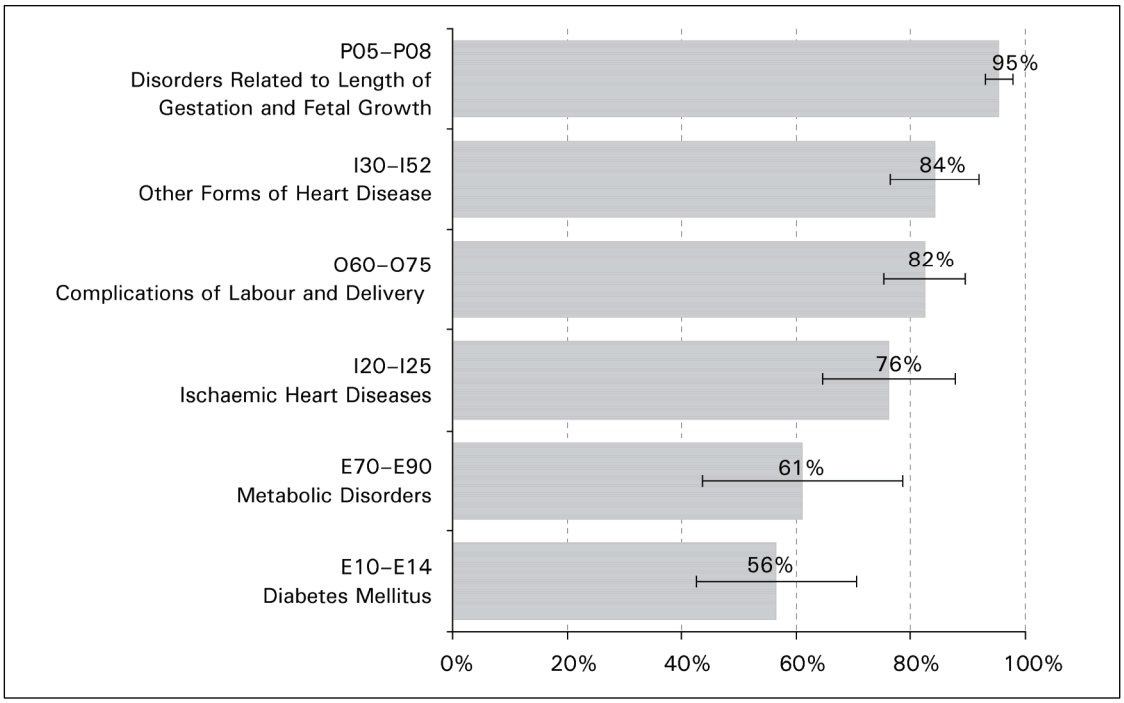
CI: confidence interval.

* Includes only significant diagnoses (types M, 1, 2, W, X or Y).

† These diagnoses were either not present in DAD or were coded as not significantly impacting the patient's length of stay or resource use (that is, diagnosis type 3).

This analysis was repeated for specific ICD-10-CA block ranges of diagnoses where there was sufficient sample from the study. This analysis found that diabetes mellitus (E10 to E14) and metabolic disorders (E70 to E90) were more prone to under-reporting to DAD than other diagnoses. That is, almost half of the time that these diseases were identified in the chart review as a significant condition, they were not reported to DAD. Figure 1 illustrates these results.

Figure 1 Frequency That Significant Diagnoses Found During the Chart Review Were Also Present and Significant in DAD, Ontario Results*



Note

* To be considered for this analysis, the study sample had to contain a minimum of 400 occurrences of the diagnosis code in the reabstracted data. The bars represent the 95% confidence intervals.

Special Focus: Diabetes Mellitus

This special focus analysis looks at the completeness of reporting diabetes mellitus to DAD. Starting in 2006–2007, diabetes mellitus became mandatory to capture on the DAD abstract whenever documented by the physician. That is, diabetes mellitus was reported to DAD regardless of whether it significantly affected the patient's length of stay or resource utilization, and hyperglycemia was also reported if the patient's blood glucose level was 14 mmol/L or higher. This change to the coding requirements made it possible to analyze the completeness of DAD data in terms of identifying hospitalizations for patients with diabetes mellitus.

The coding quality of these conditions is presented in Table 14. This analysis considers all hospitalizations for patients with diabetes mellitus that were identified during the chart review, and then compares these with the hospitalizations identified in the DAD data.[xii] The shaded boxes illustrate how frequently diabetes was represented in the same way between the DAD and reabstracted data. This includes whether it affected the patient's stay and whether hyperglycemia was present. The last column, labelled "Not Present (Under-reported)," shows the rate that diabetes was under-reported in DAD.

xii. If any diabetes code was typed as a significant condition on the abstract, then diabetes was considered to impact the patient's stay at the hospital.

Diabetes mellitus was more frequently under-reported to DAD when it did not affect the patient's hospital stay. For example, of the hospitalizations where reabstractors determined that diabetes mellitus was present but not affecting the hospital stay, 15% did not have any diabetes codes included on the DAD abstract. Although there were few cases of under-reporting diabetes, the degree to which this condition affected the patient's stay tended to be underestimated:

1. When diabetes mellitus affected the patient's stay it was often represented in DAD as a secondary diagnosis.
2. When diabetes mellitus with hyperglycemia was present, the hyperglycemia was often missing on the DAD abstract.

Table 14 Hospitalizations for Patients With Diabetes Mellitus Identified During the Chart Review Compared With Data on the DAD Abstract, Ontario Results

	Number of Hospitalizations in Study Data (in Thousands)	Hospitalizations of Patients With Diabetes Mellitus in DAD Data			
		Affects Stay and Hyper-glycemia Present	Affects Stay and Hyper-glycemia not Present	Does not Affect Stay	Not Present (Under-Reported)
Hospitalizations of Patients With Diabetes Mellitus* in Study Data					
Affects Patient's Stay (Types M, 1, 2, W, X, Y) and Hyperglycemia Present†	52.7	**38%**	29%	25%	8%
Affects Patient's Stay (Types M, 1, 2, W, X, Y) and Hyperglycemia not Present	18.6	2%	**60%**	33%	5%
Does not Affect Patient's Stay (Type 3)	51.9	1%	8%	**76%**	15%

Notes

* Hospitalizations identified with ICD-10-CA codes E10 to E14, as well as additional codes that have diabetes included in the code title, such as O24—*Diabetes mellitus in pregnancy*.

† Hospitalizations where the blood glucose level was 14 mmol/L or higher indicate hyperglycemia and had an additional ICD-10-CA code of either R73.802 or R73.812 included on the DAD abstract.

4.1.2 Completeness of Reporting Interventions to DAD

Of all the interventions found during the chart review, 87% were reported to DAD (Table 15). This sensitivity result indicates potential under-reporting to DAD of 13% of the interventions performed in the inpatient setting.

Table 15 Interventions Captured During the Chart Review Compared With Data on the DAD Abstract, Ontario Results

	DAD Data (in Thousands)		Total in Study Data (in Thousands)	Sensitivity (95% CI)
	Present	Absent		
All Interventions in Study Data*	877.7	134.4	1,012.1	**86.7** (84.0–89.5)

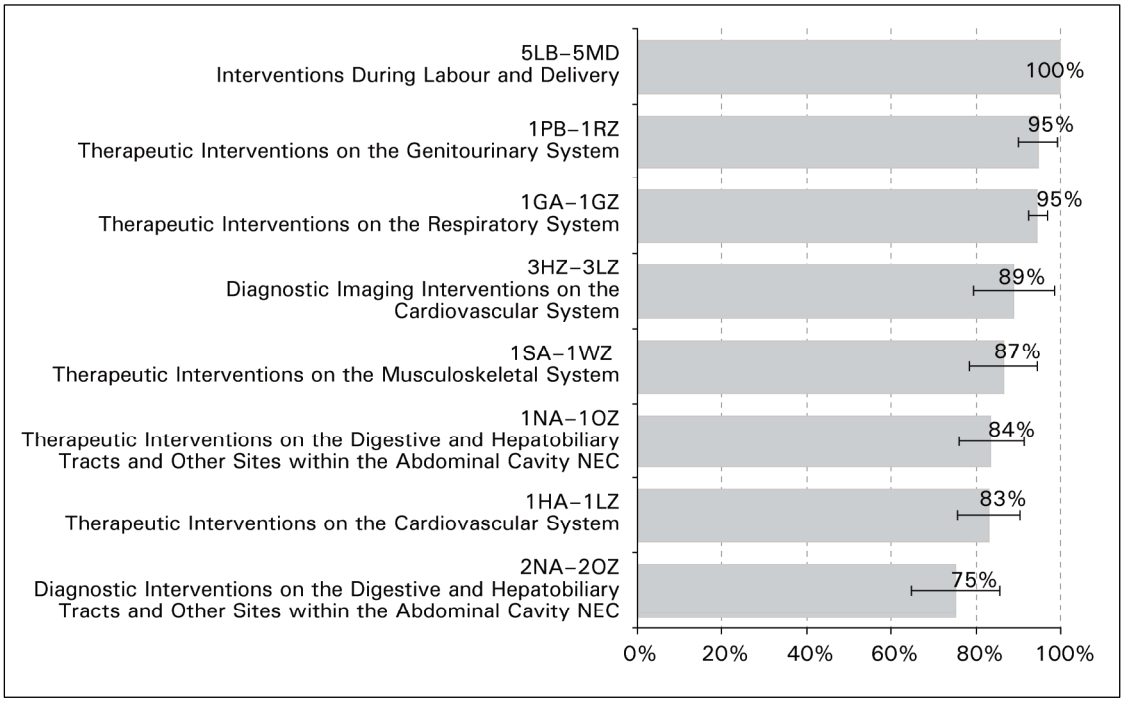
Notes

CI: confidence interval.

* Includes only those interventions that are mandatory to capture according to the 2006 Canadian Coding Standards and/or those that impact CMG+ assignment. Note that provincial variations in mandatory coding were not considered (for example, computed tomography [CT] scans are mandatory to capture in Ontario only).[6]

This analysis was repeated for specific CCI block ranges of interventions where there was sufficient sample from the study. This analysis found that diagnostic interventions on the digestive and hepatobiliary tracts (2.NA to 2.OZ) were prone to under-reporting to DAD. That is, 25% of the time when these interventions were identified in the chart review they were not reported to DAD. Figure 2 illustrates these results.

Figure 2 Frequency That Interventions Found During the Chart Review Were Also Present in DAD, Ontario Results*



Notes

NEC: not elsewhere classified.

* To be considered for this analysis, the study sample had to contain a minimum of 200 occurrences of the intervention code in the reabstracted data. The bars represent the 95% confidence intervals.

4.2 Correctness of Clinical Data Reported to DAD

This section examines the correctness of Ontario's DAD data by determining how often there is documentation in the patient chart that supports the inclusion of diagnoses and interventions on the DAD abstract.

4.2.1 Correctness of Diagnoses Reported to DAD

For the diagnoses reported to DAD as having a significant impact on the patient's length of stay or resource use, 82% had information located in the chart by the reabstractor that supported its inclusion as a significant condition. This percentage is known as the *positive predictive value* (Table 16). This positive predictive value indicates potential over-reporting of 18% of the significant diagnoses reported to DAD in Ontario, as information to support their inclusion on the DAD abstract as a significant condition was not found during the chart review. Analysis was performed on specific code blocks for diagnoses, similar to the analysis presented in Section 4.1. However, this yielded no significant findings, and as such, these results are not included in this report.

Table 16 Diagnoses on the DAD Abstract Compared With Data Captured During the Chart Review, Ontario Results

	Study Data (in Thousands)		Total in DAD (in Thousands)	Positive Predictive Value (95% CI)
	Present	Absent		
All Significant Diagnoses in DAD*	1,623.7	359.1†	1,982.8	**81.9** (79.9–83.8)

Notes

CI: confidence interval.

* See the note under Table 13 for the diagnoses that are included in this analysis.

† These diagnoses were reabstracted as either not present or not significantly impacting the patient's length of stay or resource use (that is, diagnosis type 3).

Special Focus: Diabetes Mellitus

The correctness of coding diabetes mellitus is presented in Table 17. This analysis considers all hospitalizations for patients with diabetes mellitus that were identified in DAD and then compares these with the hospitalizations identified by the reabstractor. It was not common for these conditions to be over-reported in DAD; more often the significance of diabetes was underestimated in DAD, or hyperglycemia was not indicated when present in the chart.

Table 17 Hospitalizations for Patients With Diabetes Mellitus Identified in DAD Compared With Data Obtained During the Chart Review, Ontario Results

	Number of Hospitalizations in DAD Data (in Thousands)	Study Data			
		Affects Stay and Hyperglycemia Present	Affects Stay and Hyperglycemia not Present	Does not Affect Stay	Not Present (Over-Reported)
Hospitalizations of Patients with Diabetes Mellitus* in DAD					
Affects Patient's Stay (Types M, 1, 2, W, X, Y) and Hyperglycemia Present†	20.6	**97%**	**2%**	1%	0%
Affects Patient's Stay (Types M, 1, 2, W, X, Y) and Hyperglycemia not Present	30.8	49%	**36%**	14%	0%
Does not Affect Patient's Stay (Type 3)	63.1	21%	10%	**63%**	7%

Notes

* Hospitalizations identified with ICD-10-CA codes E10 to E14, as well as additional codes that have diabetes included in the code title, such as O24—*Diabetes Mellitus in Pregnancy*.

† Hospitalizations where the blood glucose level was 14 mmol/L or higher indicate hyperglycemia and had an additional ICD-10-CA code of either R73.802 or R73.812 included on the DAD abstract.

4.2.2 Correctness of Interventions Reported to DAD

For interventions reported to DAD, 94% had supporting information located in the chart by the reabstractor (Table 18). This positive predictive value indicates potential over-reporting of 6% of the interventions in DAD, as information to support their inclusion on the DAD abstract was not found during the chart review.

Table 18 Interventions on the DAD Abstract Compared With Data Captured During the Chart Review, Ontario Results

	Study Data (in Thousands)		Total in DAD (in Thousands)	Positive Predictive Value (95% CI)
	Present	Absent		
All Interventions in DAD*	877.7	61.3	939.0	**93.5** (91.4–95.5)

Notes
CI: confidence interval.
* See the note under Table 15 for the interventions that are included in this analysis.

4.3 Coding Consistency of Diagnoses and Interventions

This section examines the consistency with which diagnoses and interventions were classified using ICD-10-CA and CCI, respectively. To measure coding consistency, this assessment focuses on only the significant diagnoses and interventions reported to DAD that were confirmed as present after the chart review.

4.3.1 Diagnosis Coding Using ICD-10-CA

Each ICD-10-CA code describes a specific condition and affected body system. These codes are indexed within ICD-10-CA into categories, blocks and chapters.[xiii] Using these groupings, codes reported to DAD were compared with the codes captured by the reabstractor. This comparison found exact ICD-10-CA code agreement for 86% of the significant diagnoses and agreement to the code category for 95% of the significant diagnoses (Table 19).

xiii. For example, autoimmune thyroiditis (code E06.3) is a type of thyroiditis (category E06), which is a disease of the thyroid gland (block E00 to E07), which is an endocrine, nutritional or metabolic disease (chapter E00 to E90).

Table 19 ICD-10-CA Code Agreement Rate for Significant Diagnoses, Ontario Results*

	Agreement Rate (95% CI)
ICD-10-CA Code, in *A.NN.NN* Format	**86.0** (84.0–88.1)
ICD-10-CA Category, in *A.NN* Format	**94.7** (93.5–95.8)
ICD-10-CA Block, a Range of ICD-10-CA Categories (for example, *A.NN$_1$ to A.NN$_2$*)	**96.7** (95.8–97.7)
ICD-10-CA Chapter, a Grouping of ICD-10-CA Blocks	**98.9** (98.4–99.5)

Notes

A: alpha character; N: numeric character; CI: confidence interval.

* See the footnote to Table 13 for the diagnoses that are included in this analysis. Diagnoses included in this analysis include only those coded as significant in DAD and also confirmed as significant by the reabstractor.

4.3.2 Intervention Coding Using CCI

The interventions provided to treat health problems are captured using the CCI classification system. CCI codes are made up of components that describe the type of health intervention, the anatomy site, the intervention used, the approach/technique, the device/method and the tissue involved.[xiv] Exact CCI code agreement on all these components was observed for 91% of the interventions, while agreement to the code rubric was observed for 97% of the interventions (Table 20). The CCI rubric describes the intervention performed and the anatomy site but does not describe the approach, technique, device, method or tissue involved.

Table 20 CCI Code Agreement Rate for Interventions, Ontario Results*

	Agreement Rate (95% CI)
CCI Code, in *N.AA.NN.AA-AA* Format	**91.4** (88.9–93.9)
CCI Rubric, in *N.AA.NN* Format	**96.5** (94.8–98.2)
CCI Group, in *N.AA* Format	**98.3** (97.3–99.3)
CCI Block, a Range of CCI Groups (for example, *N.AA$_1$ to N.AA$_2$*)	**99.5** (99.0–100)

Notes

A: alpha character; N: numeric character; CI: confidence interval.

* See the footnote to Table 15 for the interventions that are included in this analysis.

xiv. For example, 1.DK.52.LA represents a middle ear (DK) drainage (52) using an open approach (LA). There are eight sections of CCI; this code belongs to Section 1, Physical and Physiological Therapeutic Interventions. The CCI rubric for this code is 1.DK.52, the CCI group is 1.DK and the CCI block is 1.DA to 1.DZ.

4.4 Consistency in Diagnosis Typing and the Assignment of Significance

A diagnosis type accompanies every ICD-10-CA code on the DAD abstract. It is used to indicate the relationship of a diagnosis to the patient's stay in a hospital as evidenced in the physician's documentation.[6] Diagnosis typing is an important component of the DAD abstract for differentiating conditions that have an impact on the patient's length of stay or resource utilization, otherwise known as *significant diagnoses*. Significant diagnoses include the patient's most responsible diagnosis (type M), pre-admission comorbid conditions (type 1), post-admission comorbid conditions (type 2) and service transfer diagnoses (types W, X or Y).

Table 21 presents the study findings on the reliability of diagnosis typing for those conditions that were reported to DAD as significant. The study found that chart documentation supported the typing for 74% of the significant diagnoses reported to DAD; another 8% of diagnoses changed type following the chart review, but the diagnosis remained significant. For the other 18% of diagnoses, reabstractors could not locate documentation to support typing the diagnosis as significant or they could not find a reference to the diagnosis in the chart. The reliability of diagnosis typing varies among the different types: the lowest agreement rates were for pre- and post-admit comorbidities. The low agreement rate for pre-admit comorbidities is of particular interest due to the high volume of these types of conditions reported annually to DAD. The typing of the patient's most responsible diagnosis and service transfer diagnoses had high agreement rates.

Table 21 Agreement Rates on Diagnosis Typing and the Assignment of Significance, Ontario Results

	Volume (in Thousands)	Agreement Rate (95% CI)		Disagreement Rate (95% CI)
		On Diagnosis Type	On Assignment of Significance	Reabstracted as Secondary or not Reabstracted at All
All Diagnoses	**1,982.8**	**74** (72–77)	**82** (80–84)	**18** (16–20)
Most Responsible Diagnosis (M)	929.8	**86** (83–88)	**93** (90–95)	**7** (5–10)
Comorbidity (Type 1 or 2)	1,025.4	**64** (61–67)	**72** (69–75)	**28** (25–31)
Pre-Admit Comorbidity (1)	866.1	**64** (61–68)	**73** (69–76)	**27** (24–31)
Post-Admit Comorbidity (2)	159.3	**62** (54–69)	**69** (62–76)	**31** (24–38)
Service Transfer Diagnosis (Type W, X or Y)	27.6	**86** (75–97)	**88** (76–99)	**12** (1–24)

Note
CI: confidence interval.

4.5 Reliability of the Patient's Most Responsible Diagnosis

This section examines the reliability of the ICD-10-CA code that represents the patient's most responsible diagnosis. To achieve agreement on the most responsible diagnosis, the reabstractor must confirm the presence of the condition and then agree on the assignment of both the ICD-10-CA code and the diagnosis type that labels this condition as the most responsible for the patient's stay in the hospital.

Agreement on the ICD-10-CA code for the most responsible diagnosis was observed for 72% of Ontario's acute care hospitalizations reported to DAD; agreement to the code category was 81% (Table 22). Discrepancies with the most responsible diagnoses are the result of inconsistencies in the diagnosis coding or typing or could be due to incomplete reporting diagnoses to DAD.

Table 22 ICD-10-CA Code Agreement Rate for the Most Responsible Diagnosis, Ontario Results

	Agreement Rate (95% CI)
ICD-10-CA Code, in *A.NN.NN* Format	**72.3** (68.6–76.0)
ICD-10-CA Category, in *A.NN* Format	**81.4** (78.4–84.5)
ICD-10-CA Block, a Range of ICD-10-CA Categories (for example, *A.NN$_1$ to A.NN$_2$*)	**85.1** (82.5–87.8)
ICD-10-CA Chapter, a Grouping of ICD-10-CA Blocks	**90.5** (87.9–93.0)

Note
A: alpha character; N: numeric character; CI: confidence interval.

4.6 Reliability of Non-Clinical Data Reported to DAD

Non-clinical data was reported from Ontario with high reliability. Values reported to DAD for demographic data elements (for example, health care number, gender, date of birth) were confirmed following the chart review (100% agreement). Admission and discharge data (for example, admit category, entry code, discharge disposition) and institution numbers for patients who were transferred had near-perfect agreement, with differences observed for less than 2% of the records. Data abstraction of most time elements was reliable, with differences observed for less than 3% of hospitalizations. The exception to this was the recording of times for patients admitted via the emergency room.

Special Focus: Reliability of Data Used to Calculate Emergency Room Wait Times

The wait time for a patient transferred from the emergency room is the time elapsed from when an emergency department physician documents that the patient is to be admitted for inpatient treatment to the time when the patient has physically left the emergency room.[9] Table 23 examines the reliability of this derived variable. The study found that 92% of the time there was complete agreement on this wait time and only 2% of the time there was a difference that exceeded one hour.

Table 23 Reliability of Emergency Room Wait Times, Ontario Results

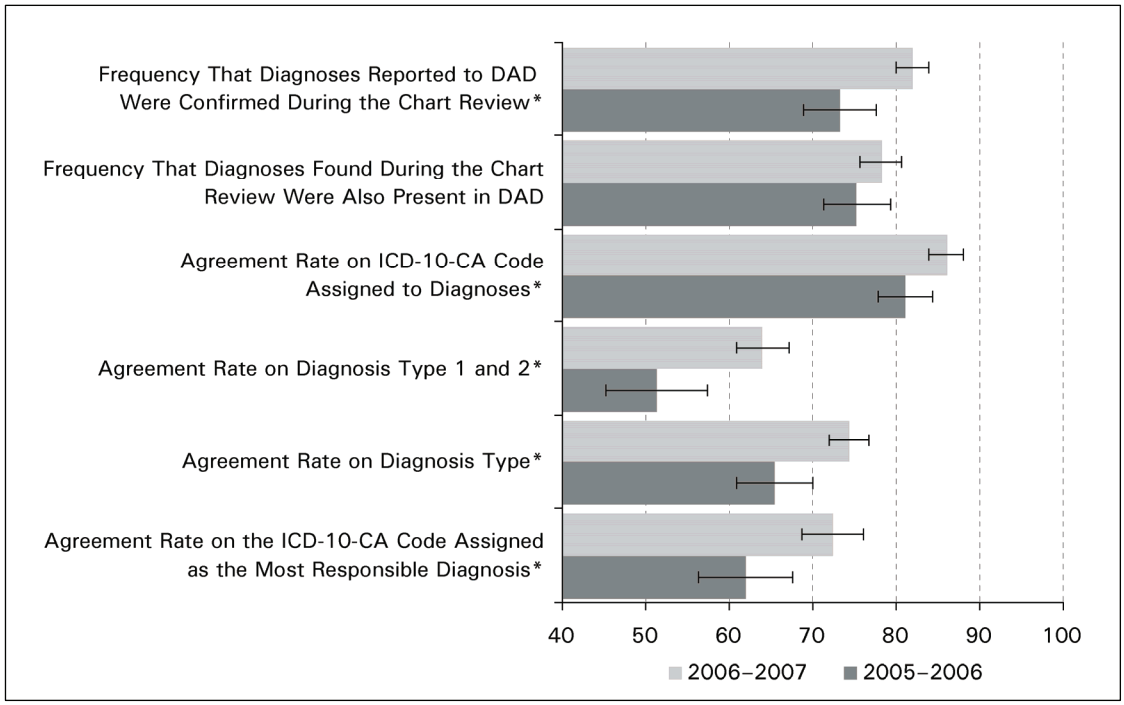
Difference in the Emergency Room Wait Times Between the DAD Data and Study Data		Volume (in Thousands)	Percent
Wait Time Longer in DAD Data	≥60 Minutes	2.7	0.8%
	30 < 60 Minutes	3.6	1.0%
	1 < 30 Minutes	4.9	1.4%
	Agreement in Wait Time	314.8	92.0%
Wait Time Longer in Study Data	-1 > -30 Minutes	3.4	1.0%
	-30 > -60 Minutes	8.6	2.5%
	≤-60 Minutes	4.0	1.2%

4.7 Changes to Coding Quality of DAD Data for Ontario Between 2005–2006 and 2006–2007

This study on the 2006–2007 DAD data submitted from Ontario found data quality improvements across many areas when compared with similar findings obtained from a previous study on DAD.[5]

The coding of the patient's most responsible diagnosis and the assignment of diagnosis types had the greatest improvements in coding quality (Figure 3). Also, more diagnostic data originally reported to DAD was confirmed by the reabstractor as documented in the patient chart. The improvements seen in 2006–2007 are statistically significant for five of these six measures.

Figure 3 Coding of Diagnoses to DAD in Ontario in 2005–2006 and 2006–2007

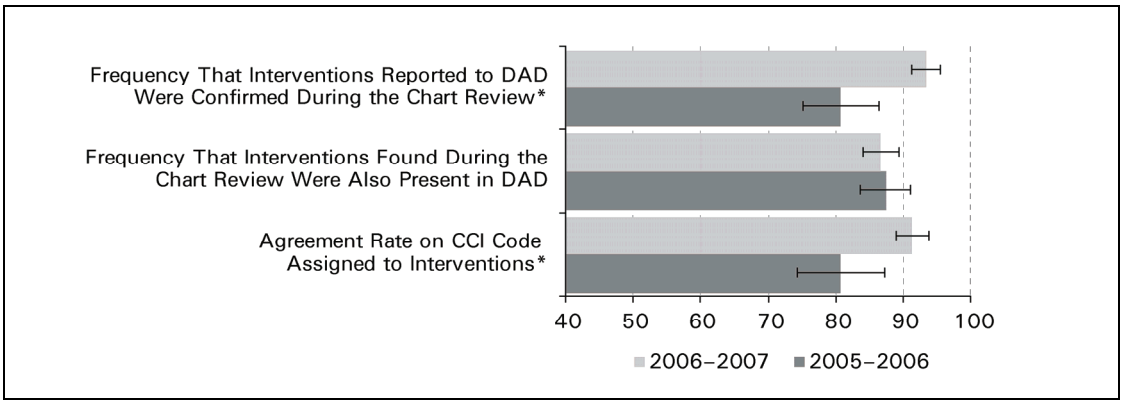


Note

* The difference in the results between 2005–2006 and 2006–2007 were found to be statistically significant ($p < 0.05$) when using a two-sided Z-test for comparing two independent proportions. The bars represent 95% confidence intervals.

Improvements in 2006–2007 were also observed for interventions (Figure 4). CCI codes describing interventions were selected more consistently. Also, more interventions that were originally reported to DAD were confirmed by the reabstractor as documented in the patient chart.

Figure 4 Coding of Interventions to DAD in Ontario in 2005–2006 and 2006–2007



Note

* The difference in the results between 2005–2006 and 2006–2007 was found to be statistically significant ($p < 0.05$) when using a two-sided Z-test for comparing two independent proportions. The bars represent 95% confidence intervals.

4.8 Summary of Findings on the Coding Quality of DAD Data for Ontario

Key findings from this chapter:

Diagnoses

- Significant improvement was found in the reliability and completeness of diagnosis data in Ontario.
- Reabstractors were not able to locate chart documentation to support the inclusion of 18% of the significant diagnoses on the DAD abstract (that is, over-reported). A similar percentage (22%) was missing from the DAD abstract when documented in the patient chart (that is, under-reported). Diabetes mellitus (E10 to E14) was under-reported.
- For significant diagnoses that were confirmed as present following the chart review, reabstractors generally agreed with ICD-10-CA codes on the DAD abstract (86% agreement) but less often agreed with the diagnosis type (74% agreement). Significant improvement was observed on the assignment of diagnosis type to pre- and post-admission comorbidities when compared with the results seen for the previous fiscal year.
- Agreement on the coding of the most responsible diagnoses was observed for 72% of all acute care hospitalizations.

Interventions

- Significant improvement was found in the reliability and completeness of intervention data in Ontario.
- Interventions continue to be coded well. Reabstractors were not able to locate chart documentation to support 6% of the interventions reported to DAD (that is, over-reported). Very few interventions (13%) were missing from the DAD abstract when documented in the patient chart (that is, under-reported).
- For interventions that were confirmed as present following the chart review, reabstractors agreed with the CCI codes on the DAD abstract 91% of the time.

Non-Clinical Data

- Most non-clinical data elements studied were reported to DAD with very high quality. The emergency room wait time derived variable was also very reliable, with only 2% of the hospitalizations having a difference in wait times of one hour or more.

5 Quality of Case-Mix Grouping Variables for Ontario Data

This chapter focuses on the study's third objective, *to assess the impact of any observed coding variation on measures of hospital output and resource utilization for Ontario data*. These measures are derived from CIHI's case-mix grouping methodology.

Case-mix grouping methodologies categorize patients into statistically and clinically homogeneous groups based on various clinical and administrative data. Adjusting for patients of different levels of acuity forms the basis for health care organization comparisons and case mix–adjusted resource utilization (www.cihi.ca/casemix). Case Mix Group resource indicators include expected length of stay and Resource Intensity Weight.

This analysis focuses on the CMG+ 2009 grouping methodology.[3]

5.1 Reliability of Grouping Hospitalizations Into Major Clinical Categories and Case Mix Groups

There are 21 major clinical categories that identify either a body system or a specific type of clinical problem. The patient's most responsible diagnosis generally determines assignment to a major clinical category. Within each major clinical category there is an intervention and diagnosis partition for Case Mix Group assignment. Case Mix Groups categorize patients into one of 558 clusters based on clinical diagnoses, procedures and resource utilization. Intervention-driven Case Mix Groups are determined by the presence of a procedure on the Intervention Partition CCI Code List; otherwise, the case is assigned to the diagnosis partition.

Table 24 summarizes the overall reliability of major clinical categories and Case Mix Groups. A total of 94% of the hospitalizations studied remained within the same major clinical category when subsequently grouped using the data obtained during the chart review. The same statistic for Case Mix Groups was slightly lower at 86%, with both the diagnosis and intervention-driven Case Mix Groups having similar results.[xv]

Table 24 Agreement Rates on Major Clinical Category and Case Mix Group, Ontario Results

	Positive Predictive Value (95% CI)
Major Clinical Category	**93.9** (92.0–95.8)
Case Mix Group	**86.1** (83.2–89.1)

Note
CI: confidence interval.

xv. For this study, it was not possible to assess the reliability of the case-mix grouping variables by specific major clinical categories or Case Mix Groups due to insufficient sample in these subpopulations.

5.2 Reliability of Assigning Comorbidity Level to Hospitalizations

CIHI's Case Mix Group comorbidity level is intended to enhance the prediction of resource utilization in acute care. It identifies diagnoses in DAD, over and above the main diagnoses, for which prolonged length of stay and/or more costly treatment could reasonably be expected. These additional diagnoses are then used to further subdivide a Case Mix Group into five subgroups. These subgroups contain a more homogeneous aggregation of patients with regard to length of stay and resource use than the Case Mix Group as a whole.

The reliability of comorbidity level to hospitalizations varied among the comorbidity levels initially assigned. Ninety-two percent of the hospitalizations that were grouped to no significant comorbidity, or level 0, remained grouped to that comorbidity level when using the data obtained from the chart review. Comorbidity levels assigned to more complicated hospitalizations, that is, those related to an increase in the case resources by 25% or more (levels 1 to 4) had lower agreement rates.[xvi] Table 25 presents the agreement rates for all comorbidity levels.

Table 25 Reliability of Comorbidity Level Assigned to Hospitalizations, Ontario Results

	Positive Predictive Value (95% CI)
Overall Agreement Rate on Comorbidity Level	**87 (85–90)**
Level 0 No Significant Comorbidity	**92** (90–95)
Level 1 Increase the Case Resources by 25%–49%	**65** (58–72)
Level 2 Increase the Case Resources by 50%–74%	**59** (47–70)
Level 3 Increase the Case Resources by 75%–124%	**56** (50–62)
Level 4 Increase the Case Resources by at Least 125%	**75** (66–85)

Cases assigned to comorbidity levels 1 to 4 were often grouped to lower comorbidity levels when using the data obtained during the chart review. For example, 21% of the cases originally assigned to the comorbidity level 1 were assigned to comorbidity level 0 when regrouped using the data from the chart review. Table 26 provides the full analysis. Note that most hospitalizations were originally assigned to comorbidity level 0 in terms of volume, and this comorbidity level has a very high agreement rate, with 8% of these hospitalizations being assigned to higher comorbidity levels with the reabstraction study data. In volumes, all increases in comorbidity levels (shaded in orange) represent 78,000 hospitalizations, whereas the decreases (shaded in blue) represent 41,000 hospitalizations. These findings on comorbidity level are related to the completeness and correctness of the diagnoses reported to DAD, as discussed in Chapter 4 and further detailed in the special focus analysis in Section 5.2.1.

xvi. There is also a comorbidity level 8, which indicates that comorbidity level does not apply. Analysis of this comorbidity level is not presented because abstracts assigned to this comorbidity level were out of scope for this study.

Table 26 Comparison of Comorbidity Level Assigned When Using DAD Data and Chart Review Data, Ontario Results

Comorbidity Level Using DAD Data	Volume (in Thousands)	Comorbidity Level Using Data From Chart Review				
		Level 0	Level 1	Level 2	Level 3	Level 4
Level 0	768.4	**92%**	5%	2%	1%	0%
Level 1	80.5	21%	**65%**	4%	6%	3%
Level 2	43.1	21%	11%	**59%**	7%	3%
Level 3	22.7	8%	13%	9%	**56%**	13%
Level 4	15.0	2%	2%	7%	15%	**75%**

5.2.1 Special Focus: Comorbidity Reporting and the Reliability of Comorbidity Levels Assigned to Hospitalizations

This special focus analysis looks at the relationship between the coding of comorbidities and the reliability of the comorbidity level assigned to a hospitalization. Comorbidity levels are derived by summing the comorbidity factors, or numbers, associated with certain comorbidities reported on the DAD abstract. Comorbidity factors apply to select ICD-10-CA codes included on the Comorbidity Factor Code List.[3] In this analysis, the comorbidities analyzed are not limited to the Comorbidity Factor Code List. All diagnoses that are captured with an associated type code of 1, 2, W, X or Y are considered.

Table 27 presents this analysis. For hospitalizations where there was agreement on the number of comorbidities, there was very high agreement in comorbidity level. However, where there were differences in the number of comorbidities reported, the agreement rates for comorbidity level dropped substantially. This illustrates the relationship between the completeness of reporting comorbidities and the reliability of comorbidity levels. For example, when there were more comorbidities in DAD than in the study data, there was generally either no change or a decrease in comorbidity level. There are exceptions. For example, of the hospitalizations with fewer comorbidities reabstracted, about 4% still had an increase in comorbidity level upon reabstraction. This occurs when the comorbidity factors assigned to the diagnoses in the reabstracted data sum to a greater amount than the comorbidity factors assigned to the diagnoses in DAD.

Table 27 Reliability of Comorbidity Level in Relation to the Number of Comorbidities Reported to DAD, Ontario Results*

Difference in the Number of Comorbidities Between the DAD Data and Study Data		Volume (in Thousands)	Change in Comorbidity Level When Using Chart Review Data (95% CI)		
			Decrease	No Change	Increase
More DAD Comorbidities†	2+	32.4	17%	79%	4%
	1	96.8	12%	84%	4%
	Agreement	542.0	2%	96%	1%
More Study Comorbidities†	1	147.4	2%	76%	23%
	2+	54.4	2%	59%	39%

Notes

* To isolate the changes that relate to comorbidity reporting, only those hospitalizations that remained grouped to the same major clinical category in the reabstraction study were analyzed.

† For this analysis, comorbidities include diagnosis types 1, 2, W, X and Y. All comorbidities were included in these counts, regardless of whether they were on the Comorbidity Factor Code List.

5.3 Reliability of the Patient's Expected Length of Stay

Expected length of stay is the average "typical" acute length of stay for various types of patients, based on data found in DAD. Expected length of stay is adjusted for comorbidity level, age, flagged intervention and intervention event if they are shown to be statistically significant. There is an expected length of stay assigned to each inpatient in DAD.

Expected length of stay values assigned to hospitalizations using DAD data were compared with the values assigned when regrouped using data obtained from the chart review. Three-quarters (76%) of the cases had no change in the expected length of stay, as illustrated in Table 28. Expected lengths of stay that were less than two days showed the highest reliability; 90% of these hospitalizations had exact agreement on the expected length of stay when using data from the chart review. Hospitalizations with longer expected lengths of stay tended to have lower agreement rates, even when allowing some amount of variation. Only 76% of the hospitalizations with expected lengths of stay of six days or longer remained within 25% of their original expected lengths of stay when using data obtained from the chart review.

Table 28 Reliability of Expected Length of Stay in Ontario, by Number of Days

Expected Length of Stay	Volume in DAD (in Thousands)	Proportion With No Change in Expected Length of Stay When Using Chart Review Data (95% CI)	Proportion With Change in Expected Length of Stay ≤25% When Using Chart Review Data (95% CI)
1.0 to 1.9 Days	213.7	**90** (85–96)	**91** (85–96)
2.0 to 2.9 Days	190.8	**77** (69–86)	**87** (80–94)
3.0 to 3.9 Days	115.3	**71** (59–83)	**83** (72–93)
4.0 to 4.9 Days	121.8	**76** (66–87)	**81** (72–91)
5.0 to 5.9 Days	74.8	**82** (74–90)	**87** (80–94)
6.0 Days or Longer	213.4	**61** (55–67)	**76** (71–81)
Total Acute Care Hospitalizations	**929.8**	**76 (73–80)**	**84 (81–87)**

Note
CI: confidence interval.

Overall, the differences in the expected length of stay resulted in a net increase in value of 8.7% (95% confidence interval, 3.5% to 13.8%) upon reabstraction. That is, there was a tendency for the reabstracted data to have slightly longer expected lengths of stay than those originally derived using the DAD data.

5.4 Reliability of the Patient's Resource Intensity Weight

The Resource Intensity Weight is a relative value derived using patient-specific cost data. It is calculated based on the service recipient cost data provided by the Ontario Case Cost Initiative, the Alberta Costing Partnership and the Fraser Health Region in B.C. This derived variable is assigned to each inpatient in DAD and provides a measure of the resource use of the patient relative to the cost of an average, typical inpatient. There is a Resource Intensity Weight associated with each combination of Case Mix Group, age, comorbidity level, flagged intervention, intervention event and out-of-hospital factors.

Resource Intensity Weights assigned to hospitalizations using the original DAD submissions were compared with the values assigned when grouped using data obtained from the chart review. For three-quarters (75%) of the cases, the Resource Intensity Weight remained unchanged. Table 29 provides further details. Hospitalizations with large Resource Intensity Weights (2.5000 or more) had the lowest agreement rates. This finding is somewhat expected, as charts with higher Resource Intensity Weights represent more complex patients who present with more diagnoses and require more interventions. There is more potential for coding errors to occur for these patients when compared with patients who present with less complicated health conditions.

Although the more complex hospitalizations had lower agreement rates in Resource Intensity Weight, the weights derived using the chart review data were often similar in magnitude. For example, only half (55%) of the hospitalizations with Resource Intensity Weights of

2.5000 or higher had exact agreement on these values, but 82% of these hospitalizations had values that changed by no more than 25%.

Table 29 Reliability of Resource Intensity Weight in Ontario, by Magnitude of Weight

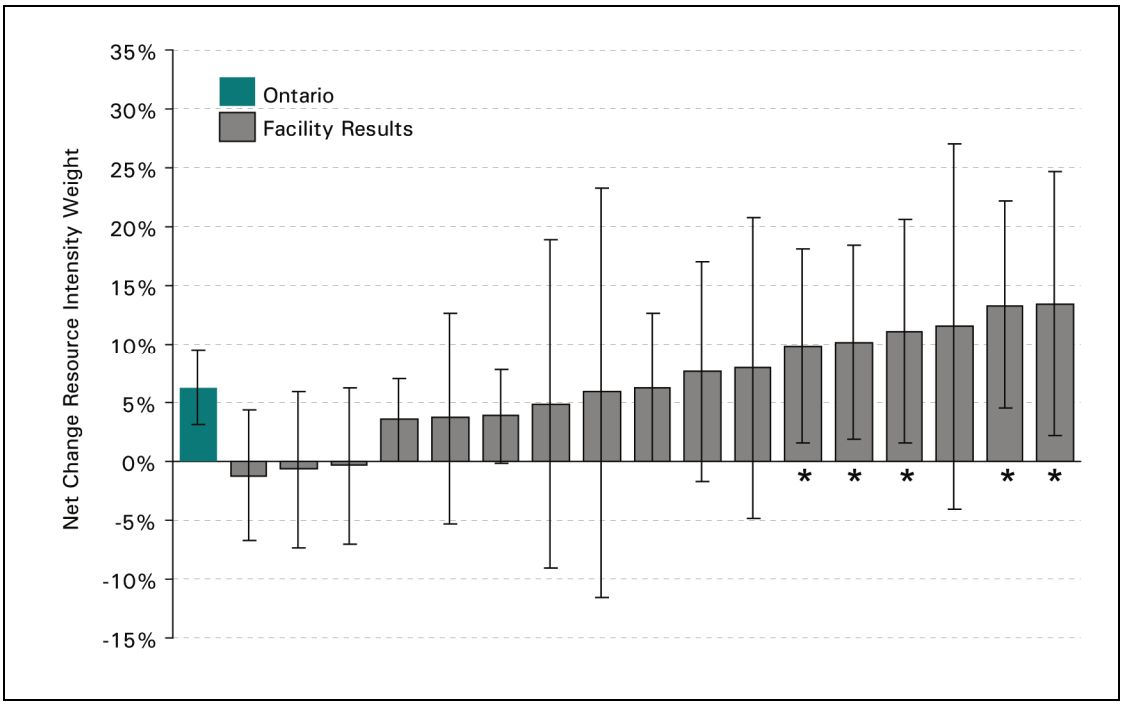
Resource Intensity Weight	Volume in DAD (in Thousands)	Proportion With No Change in Resource Intensity Weight When Using Chart Review Data (95% CI)	Proportion With Change in Resource Intensity Weight ≤25% When Using Chart Review Data (95% CI)
0.0001 to 0.4999	270.5	**78** (71–86)	**89** (84–95)
0.5000 to 0.7499	208.5	**80** (72–88)	**87** (81–94)
0.7500 to 0.9999	167.4	**79** (72–86)	**87** (80–93)
1.0000 to 1.4999	118.2	**72** (64–81)	**82** (74–90)
1.5000 to 2.4999	92.6	**69** (60–78)	**82** (75–89)
2.5000 and Higher	72.5	**55** (45–66)	**82** (75–88)
Total Acute Care Hospitalizations	**929.8**	**75 (72–79)**	**86 (83–89)**

Note
CI: confidence interval.

Overall, the differences in the Resource Intensity Weight resulted in a net increase in value of 6.3% (95% confidence interval, 3.1% to 9.5%) upon reabstraction. That is, there was a tendency for the reabstracted data to have slightly higher weights than those originally derived using the DAD data. This is a reversal of results seen in earlier reabstraction studies of Ontario DAD data, and relates to the under-reporting of diagnoses and interventions discussed in Section 4.1.

Further analysis of the net change in total Resource Intensity Weight was conducted by facility to determine if the reliability of this derived variable differed amongst the 17 participating facilities in Ontario. This analysis found that all facilities showed similar results, with only five facilities with a net increase in total Resource Intensity Weight that was statistically significant ($p < 0.05$). Figure 5 illustrates these results, with the overall Ontario results illustrated in the green bar on the left.

Figure 5 Percent Net Change in Total Resource Intensity Weight in Ontario, by Facility



Note

* Denotes facilities with a net change in Resource Intensity Weight that is significantly different from 0%. The bars represent 95% confidence intervals.

5.5 Summary of Findings for Case-Mix Grouping Variables

The impact of the observed discrepancies in the coding of diagnoses and interventions in Ontario affected the output variables from CIHI's grouping methodology in the following ways:

- Ontario saw a statistically significant *increase* in total Resource Intensity Weight upon reabstraction. No hospital had a (statistically significant) decrease in total Resource Intensity Weight upon reabstraction, a reversal of results seen in previous Ontario DAD studies, and a sign of improved adherence to coding standards.
- Three-quarters of all inpatient hospitalizations had no change in expected length of stay or Resource Intensity Weight. Agreement rates for these derived variables were lower for more complex patients who presented with more diagnoses and required more interventions. There is more potential for coding errors to occur for these patients when compared with patients who present with less complicated health conditions.
- Discrepancies in the assignment of the patient's most responsible diagnosis affected the grouping of patients to major clinical categories for 6% of the hospitalizations.
- Discrepancies in the coding of diagnoses and interventions affected the assignment of Case Mix Group for about 14% of the hospitalizations.
- Discrepancies associated with diagnosis typing and the completeness of reporting diagnoses to DAD affected the comorbidity level assigned to 13% of the hospitalizations.

6 Discussion of Coding Issues

This chapter focuses on the study's fourth objective, *to identify coding issues that arise as a result of any observed coding variation*. The coding issues listed below are based on observations from the reabstractors following their chart reviews.

The barriers for the complete and reliable collection of clinical data for DAD observed in this study were similar to those identified in the previous DAD data quality study on the 2005–2006 data.

- *Coders at the hospital did not always comply with directives from the Canadian Coding Standards*, resulting in under- and over-reporting diagnoses on the DAD abstract. Non-compliance to the coding standards also was the **main reason** for the under-reporting of interventions that were mandatory to report to DAD. Non-compliance with coding directives, including those embedded within the ICD-10-CA and CCI products, also resulted in inconsistencies in the codes originally reported to DAD compared with the codes selected by the reabstractors.

- *The documentation in the patient chart lacked clarity and could lead to different interpretations* of the significance of a diagnosis on the patient's length of stay or resource utilization or whether certain interventions were performed during the patient's stay at the hospital. Unclear documentation also led to different interpretations of which ICD-10-CA code best described the diagnosis or which CCI code best described the interventions performed. Incomplete reporting to DAD was sometimes due to coders at the hospital missing key information that was documented in the chart. However, at other times, the reabstractor was unable to find documentation about a diagnosis or intervention that was included on the DAD abstract, even if they suspected that it did occur.

7 Conclusion

7.1 Summary of Findings

Quality of Intervention Data Used by CMG+

- Most flagged interventions were well represented in DAD in terms of reliability and completeness.
- Hospitalizations with one or no intervention event present in DAD were very reliable. In general, the hospitalizations where there were discrepancies in the number of intervention events tended to be more complicated hospitalizations (that is, those with longer lengths of stay, more diagnoses and more interventions).
- There was complete and accurate reporting of out-of-hospital interventions, with only a few cases where interventions were not coded as out of hospital on the DAD abstract when it was documented as out of hospital in the patient chart.

Coding Quality of Diagnoses*

- Reabstractors were not able to locate chart documentation to support the inclusion of 18% of the significant diagnoses on the DAD abstract (that is, over-reported). A similar percentage (22%) was missing from the DAD abstract when documented in the patient chart (that is, under-reported). The rate of over-reporting decreased significantly from the previous fiscal year (27% over-reported).
- For significant diagnoses that were confirmed as present following the chart review, reabstractors generally agreed with ICD-10-CA codes on the DAD abstract (86% agreement) but less often agreed with the diagnosis type (74% agreement). Significant improvement was observed on the assignment of diagnosis type for pre- and post-admission comorbidities when compared with the results seen for the previous fiscal year.
- Agreement on the most responsible diagnoses was observed for 72% of all acute care hospitalizations. This is an increase from the 62% agreement rate observed in the previous fiscal year.

Coding Quality of Interventions*

- Reabstractors were not able to locate chart documentation to support 6% of the interventions reported to DAD (that is, over-reported). Very few interventions (13%) were missing from the DAD abstract when documented in the patient chart (that is, under-reported).
- For interventions that were confirmed as present following the chart review, reabstractors agreed with the CCI codes on the DAD abstract 91% of the time. This is an increase from 81% observed in the previous fiscal year.

Coding Quality of Non-Clinical Data*

- Most non-clinical data elements studied were reported to DAD with very high quality. The emergency room wait time derived variable was also very reliable, with only 2% of the hospitalizations having a difference in wait times of one hour or more.

Quality of Case-Mix Grouping Variables*

- Ontario saw a statistically significant *increase* in total Resource Intensity Weight upon reabstraction. No hospital had a (statistically significant) decrease in total Resource Intensity Weight upon reabstraction, a reversal of results seen in previous Ontario DAD studies and a sign of improved adherence to coding standards.
- Three-quarters of all inpatient hospitalizations had no change in expected length of stay or Resource Intensity Weight. Agreement rates for these derived variables were lower for more complex patients who presented with more diagnoses and required more interventions. There is more potential for coding errors to occur for these patients when compared with patients who present with less complicated health conditions.
- Discrepancies in the assignment of the patient's most responsible diagnosis affected the grouping of patients to major clinical categories for 6% of the hospitalizations.
- Discrepancies in the coding of diagnoses and interventions affected the assignment of Case Mix Group for about 14% of the hospitalizations.
- Discrepancies associated with diagnosis typing and the completeness of reporting diagnoses to DAD affected the comorbidity level assigned to 13% of the hospitalizations.

Coding Issues

- The barriers for the complete and reliable collection of clinical data for DAD observed in this study were similar to those identified in the previous DAD data quality study on the 2005–2006 data.
- Coders who capture data for DAD do not always comply with the Canadian Standards and other directives offered through the ICD-10-CA and CCI products.
- The documentation in the patient chart lacked clarity and/or organization and led to differences in the clinical data recorded on the DAD abstract as well as a different selection of ICD-10-CA codes to describe the diagnosis or CCI codes to describe the interventions performed.

* Findings pertain to Ontario data only.

7.2 Considerations for Improving Coding Quality

The initiatives to enhance the information and data quality of DAD need to be a shared responsibility between the health care professionals at the facilities who treat the patients and document their care, coders who extract patient information and record data on the DAD abstract, and those who maintain the DAD database and develop national coding directives. The findings from this study will be used to improve CIHI products, such as the CMG+ grouping methodology. Administrators, physicians and health records staff at the study hospitals can review the findings from this study found in their facility-specific report to identify areas where improvements are needed to promote high-quality DAD data.

8 References

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