Use of administrative health databases and case definitions in surveillance of depressive disorders: a review

R Alaghehbandan1*, D MacDonald2,3

Methods Development

Abstract

Introduction

Mental disorders are common worldwide and are associated with considerable socio-economic burden. Depressive disorders are one of the most common categories of mental disorders and often accompany other chronic diseases such as cardiovascular disease, diabetes, cancer and rheumatoid arthritis. One of the first challenges in building epidemiological knowledge of any health condition is to establish the burden associated with it. The field of psychiatric epidemiology has been slow in meeting this challenge, in part because of disagreements about thresholds regarding the presence of the condition and the failure to establish a reliable measure. Furthermore, the lack of a comprehensive national surveillance system specific to mental disorders impedes efforts to measure, monitor and subsequently improve mental healthcare delivery. This paper discusses both the opportunities and challenges of using administrative databases and case definitions for surveillance of depressive disorders.

Conclusion

Administrative databases are useful for undertaking surveillance on depressive disorders. Approaches used in developing case definitions for depressive disorders can be simple and practical and result in high sensitivity, specificity and positive predictive value.

Introduction

Mental disorders are common worldwide and are associated with considerable socio-economic burden. Depressive disorders are one of the most common categories of mental disorders and often accompany other chronic diseases such as cardiovascular disease, diabetes, cancer and rheumatoid arthritis. One of the first challenges in building epidemiologic knowledge of any health condition is to establish the burden associated with it. The field of psychiatric epidemiology has been slow in meeting this challenge, in part because of disagreements about thresholds regarding the presence of the condition and the failure to establish a reliable measure. Furthermore, the lack of a comprehensive national surveillance system specific to mental disorders impedes efforts to measure, monitor and subsequently improve mental healthcare delivery. This paper discusses both the opportunities and challenges of using administrative databases and case definitions for surveillance of depressive disorders.

Discussion

Rationale for using administrative data

Despite numerous studies focusing on mental health diseases across the globe, we still do not have an accurate picture of the incidence, prevalence or nature of mental disorders in many countries. This gap in the literature hinders our ability to evaluate the effectiveness of policies, programs and services aimed at mental health. As well, the lack of a comprehensive national surveillance system specific to mental disorders impedes efforts to monitor and subsequently improve mental healthcare delivery.

A number of methods can be employed in conducting surveillance with the method chosen depending mostly on the information needed and resources available. The most commonly recognised and used source of data in surveillance are administrative databases and surveys. However, both sources have their limitations—the former because of concerns about the accuracy of diagnostic information, and the latter because of concerns regarding the validity of self-reporting of diagnosis.

However, administrative databases are increasingly being used for many types of research in economically developed countries given their larger sample size, lower costs and increased generalisability. Administrative databases may also include a wide variety of data fields since they can be linked together at the individual level, and include large numbers of patients spanning many years. While they are considered a valuable source for many types of research, administrative databases have not been widely used for public health surveillance. This may be due to the fact that some investigators lack familiarity with database research in general. If used appropriately, administrative data targeted at a specific segment of the population (e.g. people with depressive disorders) can be an extremely

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useful tool for monitoring, planning and programming across the healthcare system, and ultimately provide evidence that can be used to improve the health of the population. Public health researchers and planners increasingly use administrative data. The validity of the data source has been established, and its strengths and weaknesses relative to data abstracted from medical records and obtained via survey are well documented. Administrative data are available from a variety of state, provincial, federal and private sources and can, in many cases, be linked. As a tool for planning and surveillance, administrative data shows great promise given that they contain consistent elements, are available in a timely manner and provide information about large numbers of individuals, many times at a population level. And because they are available in an electronic format, they are relatively inexpensive to obtain and use.

Administrative databases can also be used in observational epidemiologic studies as such data can provide population-based information on the safety and benefit of approved medications. Administrative databases have been used extensively to assess drug safety and can also provide data on rare outcomes and long-term effects that many times are undetectable in randomised controlled trials research.

### Administrative data and surveillance

The value of using administrative databases for surveillance of chronic diseases partly depends on the process used to identify the disease of interest. Several studies have described the processes employed to identify various chronic diseases from administrative databases. These processes mostly always include case definitions and the appropriate timeframes required to maximise and enhance case identification. Although most of these previous studies did not focus on depressive disorders (or mental disorders in general), the processes used to identify patients with chronic diseases using administrative databases are still relevant for this paper.

Table 1 presents various types of case definitions used for the identification of individuals with depressive disorders and other chronic diseases. In populating Table 1, PubMed was searched using relevant keywords (i.e. administrative database, chronic disease, depression, case definition) over a period of 20 years and pertinent articles were obtained and reviewed. Studies were selected and included in this review if they contained information concerning use of administrative data, and case definitions in chronic disease in general and depressive disorders in particular. The studies reviewed utilised varying methods to identify chronic diseases from administrative databases with the most utilising physician claims data (i.e. billing data or reimbursement data). The most common approach for identifying chronic diseases involved counting the number of disease-specific physician visits. Some studies listed in Table 1 used a combination of both inpatient and outpatient encounters. The most common case definition used is a combination of two or more outpatient visits or one or more inpatient visits. However, it has been reported that identifying patients with chronic diseases by using one outpatient visit versus two outpatient visits resulted in higher sensitivity but lower specificity. In contrast, other studies did not find any additional benefit of using more than one diagnosis to define a case. Furthermore, almost none of the studies considered physician specialty in their case definitions.

In addition to only using physician visits, a combination of physician visits and prescription drug use data is common. It should be noted that while this approach is valuable, some drugs may have multiple indications for different diseases which may make it difficult to link a specific drug to a specific disease.

The timeframe required to generate sufficient numbers of healthcare visits is crucial for developing a valid case definition. The optimal timeframe needed for the identification of patients with chronic diseases varies by the type of disease. A two- to three-year timeframe has been suggested as sufficient, particularly for chronic diseases with relatively structured visiting behaviour such as diabetes and hypertension. It has been shown that the errors of prevalence estimates decreases with increasing follow-up time. For conditions such as asthma, which can be challenging to diagnose, a timeframe up to five years may be required. In other cases, using a period longer than two years may not be feasible for ongoing surveillance system. Other investigators used a shorter timeframe of two years mainly because the purpose of their investigation was to identify cases, rather than to estimate the burden of the disease. Overall, there is no consensus on the optimal timeframe required to identify chronic diseases from administrative databases and it can vary on the disease of interest, the data source(s) available and the purpose of identification.

Relevant health administrative databases generally have one or more fields dedicated to diagnosis. However, in these databases the main diagnosis (versus a secondary diagnosis) may not necessarily be the most responsible reason for a specific healthcare visit. Thus, investigators using administrative databases with more than one diagnosis field sometimes suggest not considering the order of diagnosis in order to enhance and maximise case identification. A Swedish study showed that only 20% of asthma cases were identified when only the primary diagnosis is used for identification.
In the USA the importance of the order of diagnosis depends on the data source and jurisdiction. For instance, in the Medicaid database (USA) the first diagnosis listed corresponds to the relative importance of the diagnosis for a specified visit. The validity of a case definition, or an identification algorithm, can be defined as the degree to which the case definition/identification algorithm identifies a target group from administrative databases. There are two types of validity: internal and external. Internal validity refers to the accurate identification of a target population from administrative databases apart from random error. External validity refers to the application of the study findings beyond the subjects in the study. Internal validity is a prerequisite for external validity. The validity of a case definition varies depending on the objective, diseases of interest and jurisdictions. For instance, Canadian databases differ substantially from those in USA in that historically financial incentives for recording accurate diagnosis have been minimal in Canada compared to those of USA.

Of all the European databases, the General Practice Research Database (GPRD) in the UK has been the most widely used for pharmacoepidemiological research. The GPRD collects

<table>
<thead>
<tr>
<th>Case definition</th>
<th>Study</th>
<th>Country</th>
<th>Chronic disease(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 1 physician visit or ≥ 1 hospitalisation</td>
<td>Kisely et al.⁹</td>
<td>Canada (BC, ON, QC, NS, AB)</td>
<td>Mental disorders</td>
</tr>
<tr>
<td>≥ 1 physician visit or ≥ 1 hospitalisation</td>
<td>Powell et al.¹⁰</td>
<td>USA</td>
<td>Arthritis</td>
</tr>
<tr>
<td>≥ 1 physician visit or ≥ 1 hospitalisation and ≥ 1 prescription antispasmodic, laxative, anti diarrhoeal, 5HT₃ receptor agonist or 5-HT₄ receptor antagonist</td>
<td>Goff et al.¹¹</td>
<td>USA</td>
<td>Irritable bowel syndrome</td>
</tr>
<tr>
<td>≥ 1 physician visit or ≥ 1 hospitalisation within two years</td>
<td>Hux et al.⁷</td>
<td>Canada (ON)</td>
<td>Diabetes</td>
</tr>
<tr>
<td>(a) ≥ 1 inpatient or outpatient (b) HIV prescription drug</td>
<td>Fultz et al.¹²</td>
<td>USA</td>
<td>HIV/AIDS</td>
</tr>
<tr>
<td>≥ 1 physician visit or ≥ 1 hospitalisation within two years</td>
<td>James et al.¹³</td>
<td>Canada (AB, SK, MB)</td>
<td>Diabetes</td>
</tr>
<tr>
<td>≥ 2 physician visits or ≥ 1 hospitalisation within 12 months</td>
<td>Solberg et al.²⁵</td>
<td>USA</td>
<td>Diabetes, coronary heart diseases, depression</td>
</tr>
<tr>
<td>(≥ 1 physician visit or ≥ 1 hospitalisation) or antidepressant medications</td>
<td>Damush et al.¹⁵</td>
<td>USA</td>
<td>Depression post-stroke</td>
</tr>
<tr>
<td>≥ 2 physician visits and antidepressant medications</td>
<td>West et al.¹⁶</td>
<td>Canada (SK)</td>
<td>Depression</td>
</tr>
<tr>
<td>≥ 1 visit to a paediatrician</td>
<td>Daley et al.¹⁷</td>
<td>USA</td>
<td>Children with chronic medical conditions requiring influenza vaccination</td>
</tr>
<tr>
<td>≥ 1 physician visit</td>
<td>To et al.¹⁸</td>
<td>Canada (ON)</td>
<td>Asthma</td>
</tr>
<tr>
<td>≥ 1 ICU visit or ≥ 1 procedure</td>
<td>Scales et al.¹⁹</td>
<td>Canada (ON)</td>
<td>ICU admissions</td>
</tr>
<tr>
<td>≥ 1 hospital and ≥ 1 procedure</td>
<td>Baldi et al.²⁰</td>
<td>Italy</td>
<td>Cancer (breast, colon, lung)</td>
</tr>
<tr>
<td>≥ 1 hospital and ≥ 1 procedure</td>
<td>Couris et al.²¹</td>
<td>France</td>
<td>Breast cancer</td>
</tr>
<tr>
<td>≥ 1 hospitalisation in one year</td>
<td>Coffin et al.²²</td>
<td>Canada (Calgary)</td>
<td>Chronic diseases eligible for pneumococcal vaccination</td>
</tr>
</tbody>
</table>

**Table 1 Case definitions used to identify various chronic diseases from administrative databases**

In the USA the importance of the order of diagnosis depends on the data source and jurisdiction. For instance, in the Medicaid database (USA) the first diagnosis listed corresponds to the relative importance of the diagnosis for a specified visit. The validity of a case definition, or an identification algorithm, can be defined as the degree to which the case definition/identification algorithm identifies a target group from administrative databases. There are two types of validity: internal and external. Internal validity refers to the accurate identification of a target population from administrative databases apart from random error. External validity refers to the application of the study findings beyond the subjects in the study. Internal validity is a prerequisite for external validity. The validity of a case definition varies depending on the objective, diseases of interest and jurisdictions. For instance, Canadian databases differ substantially from those in USA in that historically financial incentives for recording accurate diagnosis have been minimal in Canada compared to those of USA.

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truly population-based data, has sufficient size that makes it possible to follow-up large cohorts of users of specific drugs and includes both outpatient and inpatient clinical information. Desirable improvements to the GPRD would be additional computerised information on certain variables and linkage to other healthcare databases. GPRD data have been used extensively in the area of drug safety epidemiology, contributing on several occasions to decision making by regulatory authorities and industry. There have also been studies using this database exploring various aspects of mental health epidemiology emphasising the potential benefit and feasibilities of such sources.

Reliability/validity of administrative data in surveillance

Little research has been conducted on assessing the reliability or validity of using administrative databases to explore mental illness. A recent Canadian study by Kisely et al. evaluated the usefulness of administrative data for the surveillance of mental illness using databases from British Columbia, Alberta, Ontario, Quebec and Nova Scotia. The primary data sources explored were provincial patient registries, physician billings databases and hospital discharge abstract databases. Their case definition included any patient with at least one physician visit, or one discharge from any hospital having a diagnosis in the most-responsible diagnosis field using one of the following codes: ICD-9 (International Classification of Diseases 9th Revision) from 290 to 319, inclusive, or their equivalent ICD-10 codes. Issues such as ease of data extraction, completeness of common data elements and comparability between provinces were explored. The prevalence of treated mental disorders across Canada was reported to be fairly consistent (15%), with women having a higher prevalence. The authors concluded that provincial and territorial administrative data from hospital morbidity and physician billings are useful for the surveillance of treated mental disorders. They also suggested that such a surveillance system can provide longitudinal data at relatively low cost for health service provision and planning.

In 2000, West et al. conducted a study to evaluate the validity of using the Saskatchewan Health administrative claims database for conducting research on depressed patients who were using antidepressants. The study compared medical record abstractions with the Saskatchewan Health outpatient data files (Physician Service File) and found there was a 77% agreement (kappa 0.54) for a diagnosis of depression between the medical abstraction and the Physician Service File; 71% sensitivity, 85% specificity, 86% positive predictive value (PPV) and 70% negative predictive value (NPV). This study showed a high number of true-positives and true-negatives and shows promise for the use of administrative databases in exploring depression. The authors noted that the results of this study may not be generalised to other administrative databases.

Spettell et al. conducted a study to evaluate two algorithms to identify physician-recognised depression using a large USA-managed healthcare organisation database. The first algorithm was designed to maximise sensitivity and the second to decrease false positives. The results showed algorithm 1 had a sensitivity of 95%, specificity of 65% and a PPV of 49%. Algorithm 2 had 52% sensitivity, 88% specificity and 60% PPV. Both algorithms had low PPV (falsely classifying patients as having depression), highlighting the difficulty in identifying depressed patients from administrative data using algorithms based only on diagnostic and pharmacy codes.

Rawson et al. examined the accuracy and reliability of hospital discharge diagnostic codes for schizophrenia and depressive disorder patients using Saskatchewan’s administrative healthcare utilisation data files. As a measure of external consistency the study compared the computerised data files of the Hospital Services Branch with patients’ medical charts through data abstraction forms. The study found 77.1% agreement between primary hospital discharge diagnosis and the chart discharge diagnosis for schizophrenia. There was only 58% agreement for patients diagnosed with depression; however, 93.6% of the identified patients did have some form of depression. As a measure of internal consistency a comparison was made between the hospital discharge data with physician service claim files and files from the provincial mental health branch. For schizophrenia there was 61.8% agreement between hospital data and physician service claims, and 83.4% agreement between hospital and mental health services data. For depression, there was 66.3% agreement between hospital data and physician service claims, but only 37.7% agreement between hospital and mental health services data. An examination of the mismatched codes for depressed patients indicated that they may have been coded with a depressive disorder, when in fact they had major, chronic or neurotic depression. The study demonstrated that administrative data appears to be more reliable when looking at specific mental illnesses, such as schizophrenia, as opposed to a more general diagnosis such as depression. The findings also highlight the difficulty in making an exact depression diagnosis.

A USA retrospective cohort study was carried out by Damush et al. to validate a case-finding algorithm for post-stroke depression among veteran survivors. The authors assessed the accuracy of patients’ post-stroke depression from the administrative databases (Veterans Health Administration and Medicare inpatient, outpatient and pharmacy data) through standardised chart reviews. The authors concluded that a case-finding
algorithm using outpatient ICD-9 codes or medication was the most sensitive in identifying cases of post-stroke depression. The authors also suggested that the addition of antidepressant medications in appropriate doses can improve the accuracy of the case-finding algorithm for post-stroke depression in administrative databases (Veterans Health Administration).

Comparing the PPV for the identification of individuals with chronic disorders from one setting to another may be challenging due to the underlying characteristics of administrative databases and the prevalence of the disease of interest. In one study, data from a certified cancer hospital had a higher PPV for identifying cancer cases compared to data from non-certified cancer programs. This difference in the PPV may be explained by higher cancer prevalence in the certified cancer hospitals than that of the non-certified hospital.

Hux et al. showed that when using two physician claims over two years for a diagnosis of diabetes, the sensitivity was higher than when using only one diagnosis of diabetes (90% versus 85%). Increasing the number of claims required for case definitions increased the sensitivity but reduced the specificity. In contrast, Robinson et al. did not find any meaningful gain in sensitivity by increasing the number of claims while holding the timeframe constant.

As shown in Table 2, the selected examples of case definitions show that the specificity of the case definitions in identifying individuals with chronic diseases across jurisdictions was generally higher than the sensitivity. Suitability criteria for case definitions would include adequate sensitivity and specificity, and ease the administration and utilisation. Considering sensitivity and specificity are inversely proportional, consideration must be given to the weighing in either direction in deciding what the "adequate" sensitivity and specificity would be for a specific study of this nature. This consideration relies on a number of factors including the prevalence of the disease, cost, acceptability (to both patients and healthcare professionals) and the needs of the decision makers.

Table 2 Validity of various case definitions from previous studies

<table>
<thead>
<tr>
<th>Case definition</th>
<th>Study</th>
<th>Chronic disease(s)</th>
<th>Gold standard</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>(≥ 1 physician visit or ≥ 1 hospitalisation) or antidepressant medications</td>
<td>Damush et al., USA</td>
<td>Depression post-stroke</td>
<td>Medical charts</td>
<td>Sensitivity = 62%, Specificity = 88.9%, PPV = 67.4%</td>
</tr>
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<td>≥ 1 physician visit or ≥ 1 hospitalisation and ≥ 1 prescription antispasmodic, laxative, anti diarrheal, 5HT1 receptor agonist or 5-HT4 receptor antagonist</td>
<td>Goff et al., USA</td>
<td>Irritable bowel syndrome</td>
<td>Medical charts</td>
<td>PPV = 83%</td>
</tr>
<tr>
<td>≥ 2 physician visits or ≥ 1 hospitalisation within 12 months</td>
<td>Solberg et al., USA</td>
<td>Diabetes, coronary heart diseases, depression</td>
<td>Medical charts</td>
<td>PPV Diabetes = 0.97–1, Coronary heart diseases = 0.95, Depression = 0.65–0.99</td>
</tr>
<tr>
<td>≥ 1 physician visit or ≥ 1 hospitalisation within two years</td>
<td>Hux et al., Canada (ON)</td>
<td>Diabetes</td>
<td>(a) Prescription drug data (b) NPHS (c) Medical charts</td>
<td>(a) Sensitivity for one claim = 94%, for two claims = 91% (b) Sensitivity for one claim = 95%, for two claims = 85%; PPV for one claim = 44%, for two claims = 64% (c) Sensitivity for one claim = 93.4%, for two claims = 97.1%; PPV for one claim = 61.3%, for two claims = 79.8%</td>
</tr>
</tbody>
</table>

Review
**Conclusion**

Most studies have similar case definitions focusing on different types of chronic diseases. The outcome of most studies is variable with respect to sensitivity, specificity and PPV, depending on the chronic disease studied and the jurisdiction in which the study took place. The gold standard used to validate the case definitions has mostly been medical charts. It is important to note that using a chart review as the gold standard may not always be cost-effective given the lack of availability of some clinical information in medical charts. Some of the pertinent challenges concerning the use of administrative data may include: the diagnoses might not be accompanied by documentation of relevant diagnostic testing, there may be cases of undercoding and diagnostic procedures may often be underreported. Furthermore, it should be noted that there may be the failure of physicians and patients to report depression because of the stigma of the mental illness or there may be confounding of the diagnosis by other medical co-morbidities. Overall, administrative databases are useful for undertaking surveillance on depressive disorders. Approaches used in developing case definitions for depressive disorders can be simple and practical and result in high sensitivity, specificity and PPV.

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**Table 2 Continued**

<table>
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<th>Study</th>
<th>Chronic disease(s)</th>
<th>Gold standard</th>
<th>Validity</th>
</tr>
</thead>
</table>
| Physician visits | ≥ 2 physician visits and antidepressant medications | West et al., Canada (SK) | Depression | Medical charts | Sensitivity = 71%  
|                  |       |                    |               | Specificity = 85%  
|                  |       |                    |               | PPV = 86%  
|                  |       |                    |               | NPV = 70%  |
| ≥ 1 visit to a paediatrician | Daley et al., USA | Children with chronic medical conditions requiring influenza vaccination | Medical charts | Sensitivity = 72%  
|                  |       |                    |               | Specificity = 95%  |
| ≥ 1 physician visit | To et al., Canada (ON) | Asthma | Medical charts | Sensitivity = 91.4%  |
| Hospitalisation | ≥ 1 ICU visit or ≥ 1 procedure | Scales et al., Canada (ON) | ICU admissions | Critical Care Research Network patient registry (CCR-Net) | Sensitivity = 92%  
|                  |       |                    |               | Specificity = 99%  
|                  |       |                    |               | PPV = 84%  
|                  |       |                    |               | NPV = 100%  |
| ≥ 1 hospital and ≥ 1 procedure | Baldi et al., Italy | Cancer (breast, colon, lung) | Piedmont Cancer Registry of Turin (PCRT) | Breast (sensitivity = 76.7%; PPV = 92.6%)  
|                  |       |                    |               | Colon (sensitivity = 72.4%; PPV = 87.9%)  
|                  |       |                    |               | Lung (sensitivity = 80.8%; PPV = 78.7%)  |
| ≥ 1 hospital and ≥ 1 procedure | Couris et al., France | Breast cancer | Cancer Registry | Sensitivity = 64.1%  
|                  |       |                    |               | Specificity = 99.9%  |
| ≥ 1 hospitalisation in one year | Coffin et al., Canada (Calgary) | Chronic diseases eligible for pneumococcal vaccination | | Sensitivity = 83%  
|                  |       |                    |               | Specificity = 78%  
|                  |       |                    |               | PPV = 87%  
|                  |       |                    |               | NPV = 72%  |
| ≥ 1 hospitalisation | Penberthy et al., USA | Cancer | Virginia Cancer Registry | PPV = 84%–98%  |

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References


