

**DEPRESSION AND HEALTH SERVICE UTILIZATION IN PHYSICALLY  
DISABLED MEDICAID FEE-FOR-SERVICE ENROLLEES**

**BY**

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## Title

Recent depressed mood was associated with greater overreporting of health service use in disabled Medicaid recipients.

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## Abstract

*Objective:* The relationship between depression and validity of self-reports of health service utilization has not been well explored. We sought to test the hypothesis that depressed mood is associated with overreporting of utilization.

*Study Design and Setting:* Using data from a 2001 telephone needs assessment survey of 484 physically disabled working-age Medicaid enrollees, we compared self-reports of emergency room visits, hospitalizations, and inpatient nights during the previous year to paid Medicaid claims for the same time period. Respondents who reported at least 14 days of sadness during the previous month were classified as having recent depressed mood, and were compared with other respondents for reporting accuracy.

*Results:* Using Medicaid claims as the criterion measure, survey respondents overreported the number of emergency room visits, hospitalizations, and inpatient nights during the previous year. After adjustment for demographics and factors associated with reporting error, recent depressed mood increased overreports of emergency room visits by 37% and was associated with overreporting inpatient nights by 1-7 nights.

*Conclusion:* Recent depressed mood is associated with overreporting of health service utilization in disabled working-age adults. Self-reports of health service use should be

used with caution when assessing the relationship between depression and health service utilization.

## Introduction

As the number of persons with disabilities or chronic medical conditions increases over the coming decades, the costs of providing health care to the disabled and chronically ill will continue to grow[1]. Research on health service utilization in this population will be important to understanding the needs for, costs of and outcomes of health services, and to shaping health care policy in a limited resource environment. Depression is common in populations with high burdens of chronic disease and disability[2-5] and is linked with high levels of non-mental health service utilization and costs[6-8]. Research on the relationship between depression and health service utilization in the disabled or chronically ill will thus also become increasingly important.

There has been relatively little investigation of the validity of self-reported health service utilization in non-elderly populations with disabilities or chronic illnesses, such as disabled working-aged Medicaid enrollees[9,10]. To our knowledge no one has looked within this population at the validity of self-reports of hospitalizations or emergency room visits, or at the possibility of an association between depression and overreporting health service utilization. In high-utilizing populations with a high prevalence of depression, such as persons with chronic disease or disability, it is particularly important to know whether depression is associated with more overreporting (beyond chance) of costly encounters such as hospitalizations and emergency room visits. Such a relationship would have important implications for health service policy and health services research, both within and beyond this population, since it would suggest that previous studies of depression and health service use relying on self-reports of utilization may be biased, and that survey findings of associations between depression and increased

health service use may reflect overreporting rather than true patterns of elevated utilization. We therefore conducted this study to test the hypothesis that depressed mood is associated with overreporting of hospitalizations and emergency room visits among physically disabled working-age Medicaid enrollees.

### Methods

We used two sources of utilization information for our study comparison. One source was the Health Care Needs of Adults with Disabilities Survey, a telephone needs assessment survey of Rhode Island (RI) working-age fee-for-service Medicaid enrollees with physical disabilities that was conducted in March and April 2001 by the RI Medicaid Research and Evaluation Project[11]. The second source was paid medical bills (claims files) for the same time period, which were extracted from the state's computerized Medicaid Management Information System (MMIS) and transformed into health service encounters. For the purposes of this study, we considered the MMIS data as the criterion measure and compared self-reports of health service encounters from the Survey to utilization data obtained from the MMIS. Our study was reviewed and approved by the university institutional review board.

#### *Participants and procedures*

The sampling frame for the needs assessment survey was the MMIS. All state fee-for-service Medicaid enrollees who were ages 21-64, enrolled during the period from October 1, 1999 to September 30, 2000, and living in the community were selected. Because the Survey was intended to focus on Medicaid recipients with physical disabilities rather than mental disabilities, all persons identified on the MMIS as receiving services restricted to persons with severe and persistent mental illness, mental

retardation or developmental disabilities were eliminated from the sampling frame. Persons who had a recent hospitalization or emergency department visit with a principal diagnosis of schizophrenia were also eliminated from the sampling frame. However, since persons with physical disabilities or chronic health conditions may have other concomitant mental or emotional conditions, persons with hospitalizations or emergency department visits for other mental disorders (including depression) were not eliminated from the survey population.

The eligible MMIS population was 15,106 persons, from which a sample of 1,800 was randomly selected and a total of 636 were contacted. Of those contacted, 556/636 (87%) participated in the survey (see Figure 1). Respondents were asked about their health status, types and prevalence of health problems and conditions, access and barriers to health care, and unmet service needs.

### *Measures*

#### *Survey Questions*

*Depression.* A question adopted from the Behavioral Risk Factor Surveillance System Survey (BRFSS) and included in this Survey asked how many days during the previous 30 days the respondent felt sad, blue or depressed[12]. We categorized respondents in two groups: those with fewer than 14 days of sadness in the past month were classified as not recently experiencing depressed mood, while those with 14 or more days of sadness were classified as having recent depressed mood. The CDC has used 14 or more days of sadness or depression in the past 30 days to estimate the prevalence of recent depressed mood[13-15], and this survey question has been shown through

comparison with the MOS SF-36 to have acceptable construct, criterion, and known-groups validity[16,17].

*Health Service Utilization.* Each participant was asked how many times during the past year they had gone to a hospital emergency room and how many times they had been admitted to the hospital. If the respondent said they had been admitted to the hospital at least once, they were asked how many nights in the past year they had spent in the hospital (see Figure 2).

*Other Variables.* Several survey questions captured respondent characteristics that have been examined in other studies for their relationship to reporting validity. Such information collected during the telephone survey included self-rated general health status (excellent, very good, good, fair, or poor), highest grade of school completed (less than high school, high school, more than high school), and race/ethnicity (white, black/African-American, Spanish/Hispanic, or Other). Very few participants reported good, very good or excellent health, so we categorized general health status into good or better versus fair or poor.

#### *Computerized Records*

Criterion information on health service utilization for comparison to self-reports was taken from the MMIS files of paid claims. For each individual enrollee, claims for the 365 days before the survey date were selected from administrative claims data, so that the time frame examined would be equivalent to the ‘past year’ covered by the survey questions. A combination of claim type, bill type, and revenue code was used to identify claims related to emergency room visits and inpatient hospitalizations, and the totals of emergency room visits, hospitalizations and nights in the hospital were counted. Enrollee

hospital claims with contiguous dates of service were counted as part of a single hospitalization. The procedures followed in identifying and counting emergency room visits and hospitalizations were those developed and used by the state Medicaid staff and affiliated researchers in defining these events for monitoring and research purposes[18]. Additional information from computerized Medicaid enrollment files included age, sex, and enrollment periods for each participant.

We considered information derived from the MMIS claims files to be the criterion measure for utilization counts because Medicaid enrollees with disabilities tend to have limited financial resources and little access to non-public health insurance[19]. For enrollees with both Medicare and Medicaid insurance (dual eligibles), Medicare is the primary insurer for acute care services, including physician and hospital services[20]. However, state Medicaid research and evaluation staff believe that information on hospital-related utilization is included in MMIS claims data even when Medicaid is charged a copayment of \$0 for hospitalizations[18]. Survey participants self-reported whether or not they had additional health insurance (Medicare or private insurance), and we performed sensitivity analyses by reported additional health insurance status for all multivariable models.

### *Data Analysis*

The relationship between any self-reported (SR) and any MMIS utilization was explored for emergency room visits and hospitalizations. The mean, median and range of self-reported utilization, MMIS utilization, and their difference (SR – MMIS) were then computed for emergency room visits, hospitalizations, and nights in hospital. Because the distributions of utilization counts were skewed and not symmetric around the median,

we used the sign rank test to assess whether respondent self-reports and computerized counts were the same for each type of utilization.

We wished to test the hypothesis that depression leads specifically to overreporting, rather than to inaccuracy (both overreporting and underreporting). Since a pattern of both overreporting and underreporting could lead to no net difference between self-report and the criterion measure, we decided to examine both overreporting and underreporting. Because we did not assume that the relationship between recent depressed mood and overreporting was the same as the relationship between depressed mood and underreporting, we analyzed overreports and underreports separately. We restricted the analysis of overreporting to cases in which there was either agreement or overreporting, while for analyses focusing on underreporting we restricted the sample to cases in which some utilization was recorded in MMIS and the self-report reflected either agreement or underreporting.

We used the Mann-Whitney two-sample statistic to test whether the differences between self-report and MMIS (SR-MMIS) were the same for respondents with and without recent depressed mood. We then examined 1) the relationship between report of recent depressed mood and any overreporting or underreporting of utilization, and 2) the relationship between recent depressed mood and the amount of overreporting or underreporting.

Logistic regression analyses were conducted to estimate the relationship between recent depressed mood and having any overreport or underreport of utilization. In analyses with very small sample sizes, we used Agresti's adjusted confidence interval methods[21]. In order to estimate differently specified models for overreporting and

underreporting, we ran two separate models, which is a form of estimating a multinomial response[22]. Multivariable models included general social and demographic factors (age, gender, race and education) as well as other factors reported in previous studies to affect reporting accuracy (amount of recorded utilization, general health status). Regression analyses estimating the relationship between depressive symptoms and amount of reporting discrepancy were also conducted separately for overreports and underreports of each type of utilization. We used Poisson or negative binomial regression as appropriate for the amount of dispersion in the count data. For data that were overdispersed and did not fit a Poisson or negative binomial model we used multinomial regression. When extreme SR-MMIS outliers were present, analyses were initially run after exclusion of outliers, then repeated with all data points included. All analyses were run using SAS 9.1.3 for Windows (SAS Inc., Cary, NC).

## Results

### *Sample characteristics*

We eliminated from the Survey sample respondents who did not give information on the number of sad, blue or depressed days in the previous month (n=8) or did not answer any questions about health service utilization (n=1). We also eliminated surveys completed by proxy respondents (n=15). Although persons with developmental or other psychiatric disabilities were initially screened out of the Survey population through specialty service use criteria, a few Survey respondents self-reported developmental disabilities (n=14) or serious mental illnesses such as bipolar disorder (n=9) or schizophrenia (n=5), and we eliminated these respondents from our sample. Persons identified on the Medicaid enrollment files as not continuously enrolled in Medicaid for

at least 365 days prior to the date of their survey were also excluded (n=20), as the MMIS billing files would not contain their complete utilization information for the previous year. The total number of Survey respondents available for analysis after these exclusions was 484. For analyses of self-reported emergency room visits we eliminated respondents who did not provide information on emergency room visits (n=4), and for analyses of self-reported number of nights in hospital we eliminated respondents who provided information on their hospitalizations but not on the number of inpatient nights (n=2).

MMIS data on race, age, and sex indicated that survey respondents and the base population of those eligible were similar in racial/ethnic distribution, but that the Survey participants were more likely to be women (62% of participants versus 57% of those eligible) and to be older (53% of participants aged 50-64 years, versus 43% of those eligible)[11]. See Table 1 for characteristics of the Survey sample. Persons who reported at least two weeks of feeling sad, blue or depressed in the previous month were less likely to report having health insurance in addition to Medicaid ( $p<0.05$ ) and more likely to report having fair or poor general health status ( $p<0.0001$ ).

#### *Self-reported and MMIS utilization*

Among the 82 persons with at least one MMIS paid claim for a hospitalization, 95% (78/82) self-reported at least one hospitalization. Likewise, 92% (153/166) of persons who had an MMIS paid claim for an emergency room visit also self-reported having at least one emergency room visit. However, approximately 43% (116/269) of respondents self-reporting an emergency room visit did not have any MMIS paid claims

for emergency room visits, and approximately 43% (60/138) of respondents self-reporting a hospitalization did not have any MMIS evidence of a hospitalization.

The range and mean of counts for each type of utilization was higher for data obtained from self-reports than for data obtained from MMIS records. See Figures 3-5 for graphs of counts obtained from self-reports and MMIS paid claims, among respondents reporting one or more services. The mean differences between self-reports and MMIS (SR-MMIS) was positive, reflecting overreporting, on average, for each type of service (mean difference for emergency room visits = 0.99 (95% CI = 0.82, 1.15); mean difference for hospitalizations = 0.31 (95% CI = 0.23, 0.38); mean difference for inpatient nights = 2.02 (95% CI = 1.37, 2.67)). The sign rank test was significant at  $p < 0.0001$  for each type of utilization, indicating that self-reports were significantly different from counts obtained from MMIS.

Table 2 shows the distribution of differences between self-report and MMIS (SR-MMIS) for utilization counts of each service. The percent perfect agreement (SR-MMIS=0) was much lower for emergency room visits than for hospitalizations or number of inpatient nights. In each case, perfect agreement between MMIS and self-report was concentrated among persons who did not use services, and agreement was lower for persons who used services. Among the 166 persons who had a paid claim for an emergency room visit, 35 (21%) had a self-report that agreed with MMIS; among the 82 respondents who had a hospitalization in MMIS, 38 (46%) had a self-report that agreed with MMIS; and among the 80 respondents with a hospitalization in MMIS and reporting information on number of inpatient nights only 13 (16%) reported the same number of inpatient nights as reflected in MMIS. For survey respondents with utilization in MMIS,

the exact number of inpatient nights was the least likely, and the number of hospitalizations was the most likely, to be reported in perfect agreement with MMIS.

### *Underreporting*

The number of persons in our analyses of underreports was quite small, and we were therefore able to perform univariate, but not multivariate, analyses of the relationship between recent depressed mood and underreporting. Of the 166 persons who had an emergency room visit recorded in MMIS during the year before the survey, 35 persons self-reported the same number of visits, and 36 persons underreported. The total sample for an analysis of emergency room underreports was therefore 71 persons. Having 14 days or more of sadness in the previous month was not significantly associated with any underreport of emergency room use (OR=1.18, 95% CI = 0.46 to 3.00).

The results are similar for the analysis of hospitalization underreports. Of the 82 persons with a hospitalization recorded in MMIS during the year before the survey, 38 reported the number of hospitalizations correctly and 8 underreported. Having 14 days or more of sadness in the previous month was not significantly associated with any underreport of emergency room use (OR=1.63, 95% CI = 0.34, 7.79).

In the case of inpatient hospital nights, 80 persons with hospitalizations in MMIS also reported information on the number of inpatient nights. Of these persons, 13 reported the same number as in MMIS, and 11 underreported. The total sample for an analysis of hospital night underreports was therefore 24 persons. There was a trend towards an association between having 14 days or more of depressed mood in the previous month and underreporting rather than correctly reporting the length of stay (OR=5.02, 95% CI = 0.87 to 28.99).

### *Overreporting*

The number of persons in our analyses of overreports was larger, and we were therefore able to perform both univariate and multivariable analyses of the relationship between recent depressed mood and overreporting. Univariate analyses resulted in trends towards overreporting emergency room visits (OR=1.38, 95% CI = 0.95 to 2.01) and hospitalizations (OR=1.64, 95% CI = 1.01 to 2.67) and significantly higher odds of overreporting nights in hospital (OR=1.77, 95% CI = 1.15 to 2.72) for persons with recent depressed mood. The strength and significance of these associations changed little after adjustment for demographics, health status and MMIS utilization. The odds ratio for overreporting emergency room visits became 1.31 (95% CI = 0.86, 1.98), the odds ratio for overreporting hospitalizations became 1.42 (95% CI = 0.85, 2.38), and the odds ratio for overreporting nights in hospital became 1.89 (95% CI = 1.08, 3.30).

Negative binomial regression analyses of depressed mood and overreports of emergency room visits and hospitalizations after adjusting for potential confounders are summarized in Table 3. Having 14 or more days of depression during the previous month increased the predicted counts of emergency room visit overreports by 41% in the univariate analysis ( $p=0.023$ ) and by 37%, holding age, sex, race, education, self-reported health and any utilization in MMIS constant ( $p=0.036$ ). Having 14 or more days of depression during the previous month increased the predicted counts of hospitalization overreports by 35% ( $p=0.020$ ) when considering recent depressed mood alone, and by 24% after adjustment for covariates, but this relationship was not statistically significant ( $p=0.331$ ). For adjusted analyses of overreporting of both emergency room visits and

hospitalizations, having a visit recorded in MMIS was the most important factor in amount of overreporting.

The overreporting of inpatient length of stay was highly skewed, with ten respondents overreporting by 30 days or more and one respondent overreporting 120 inpatient nights. The distribution of overreport counts did not fit either a Poisson or a negative binomial model, and so we used multinomial logit regression to estimate the relationship between recent sadness and overreporting of one week and more than one week, compared to no overreporting. We found that recent sadness was associated with increased odds of reporting between one and seven inpatient days (univariate odds ratio = 1.95, 95% CI = 1.20, 3.15, and adjusted odds ratio = 2.11, 95% CI = 1.14, 3.90) and non-significantly associated with increased odds of reporting by more than seven inpatient days (univariate odds ratio = 1.46, 95% CI = 0.74, 2.89, and adjusted odds ratio=1.43, 95% CI = 0.69, 2.34). This indicates that when overreporting is small, persons with recent depressed mood are more likely to overreport, but when overreporting is extreme, recent depressed mood is not associated with overreporting.

For all types of overreporting, we performed sensitivity analyses by whether the respondent reported having other health insurance in addition to Medicaid. The addition of this variable to our models either did not affect the results of the regression, or increased both the importance and significance of recent depressed mood (data not shown).

## Discussion

In a comparison between survey self-reports and a Medicaid database of paid claims for emergency room visits and hospitalizations, we found that physically disabled

working-age Medicaid enrollees overreported, on average, the number of emergency room visits, hospitalizations, and inpatient nights during the previous year. Against this background of highly prevalent overreporting, we found trends towards an association between a report of recent depressed mood and having any overreport of emergency room, hospital, or inpatient night utilization, and we found that a report of recent depressed mood was associated with greater overreporting of the number of emergency room visits and inpatient nights.

Most previous studies on validity of self-reported medical service use have focused on general populations[23-33], elderly populations[29,34-42], or populations of individuals with severe and persistent mental illness or substance abuse problems[43-48], and relatively few studies have looked at accuracy of self-reported utilization in non-elderly populations with significant physical health problems[9,49,50]. There is therefore little directly comparable available evidence about the validity of self-reports of emergency room visits or hospitalizations in populations similar to ours. However, compared to other studies examining the validity of self-reported hospitalizations or emergency room visits, we found lower levels of perfect agreement between self-reports and the criterion source of utilization information.

Our findings of 78% concordance between self-reports and MMIS records for hospitalizations contrast with other studies in which there is a concordance of approximately 90% between self-report and provider or registration data for the number of inpatient hospitalizations[33,42,49,51]. Most of these studies have had a shorter recall period or a healthier population with fewer hospitalizations, or both, and since both the length of recall period and greater utilization make accurate reporting more difficult, our

findings of lower concordance may be related to these factors[29]. An exception to these study characteristics is Wolinsky's study of concordance between 12-month self-reports and Medicare claims for hospitalizations in the very old[42]. This study found a concordance between self-report and computerized claims of 89%, and had a claims-based hospitalization rate of 16%, of whom 24% had been hospitalized more than once, which is comparable to the 17% and 36% (respectively) in our study. Possible explanations for our findings of lower concordance between self-report and claims are that our sample had higher rates of multiple hospitalizations, or that Medicaid claims do not perform quite as well as Medicare claims at capturing hospitalizations. Our study does agree with the Wolinsky study in finding that overreporting of hospitalizations was more prevalent than underreporting.

Our finding of more overreporting than underreporting for emergency room visits is also similar to the findings of a previous study in outpatients with chronic illnesses, but the 49% perfect concordance we found is much lower than the 79% reported in that study[49]. Again, compared to the population in that study, our population has very high levels of emergency room utilization and was asked to cover a recall period of twelve months rather than six months; these factors may explain our findings of lower concordance between self-report and computerized records. Other studies have found that underreporting of emergency room visits is more common than overreporting. A previous study in elderly outpatients with substantial comorbidities found only 35% perfect concordance between self-report and administrative data on emergency room visits during the previous year, but 8% of the study sample reported ER utilization outside the urban medical system providing administrative data[37]. Nevertheless, this

study found that underreporting of emergency room utilization was slightly more prevalent than overreporting. A validation sub-study of randomized trial participants in treatment for alcohol abuse or dependence found 58% perfect concordance between agency records and self-report of emergency room visits during the previous year, and also found that underreporting was slightly more common than overreporting[48]. Our study does agree with other studies comparing self-reports of emergency room visits and hospitalizations that hospitalizations are reported with more accuracy than emergency room visits[37,48,49].

Previous research indicates that the accuracy of self-reports depends primarily upon the length of the recall period, the salience of the medical encounter, and the frequency of the service use, as well as the form and conduct of the survey[52-55]. The major respondent characteristics positively associated with validity of utilization self-reports are higher levels of education and better health status[31]. Our study is consistent with previous research in finding that poorer health is associated with less accurate self-reporting. Depression has only occasionally been considered as a modifier of reporting validity for health service utilization[26,39,49,56]. Our study is consistent with most of the previous research that has explored relationships between depression and reporting of health service utilization.

An early study examining the validity of self-reports of outpatient care found that a higher score on a scale of demoralization was associated with more overreporting of outpatient care[26]. In a more recent study comparing computerized records and self-reports of health service utilization, persons who were depressed and/or anxious reported significantly more hospitalizations, emergency room visits, and other non-mental health

service utilization than persons with neither depression nor anxiety, but computerized records of hospitalizations, outpatient visits, and costs showed no significant differences between the two groups[56]. (The authors of this study acknowledged that self-report data may reflect accurate recall of utilization at institutions outside those included in the computerized records, and our study is stronger in this respect, since we believe that hospital or emergency room utilization is less likely to have occurred outside Medicaid for our study population.) In contrast, Ritter et al. (2001) found that the score on an index of depression was not related to the total discrepancy between self-reported and computerized six-month outpatient, hospital, and emergency room utilization in a sample of HMO patients with chronic disease [49]. However, overreports and underreports were not presented or analyzed separately in this study, and it is possible that higher levels of overreporting (if present) could have been cancelled out by higher levels of underreporting (if present). Finally, a recent study assessing the concordance between 12-month self-reports and Medicare claims for hospitalizations and physician visits (including emergency room visits) in the very old found that there was no association between depressive symptoms and overreporting of hospitalizations, although survey respondents without depressive symptoms were less likely to underreport hospitalizations[42]. Concordance between self-reports and claims data for physician visits was very low, and there was no relationship between depressive symptoms and under- or overreporting of physician visits. Self-reported poor memory was an important predictor of both under- and overreporting of physician visits, which suggests that further research on associations between depression and self-reports should incorporate information on memory status when possible.

### *Limitations*

Our study has some limitations, most prominently the nature of our criterion measure and the measurement of our exposure.

The nature of our criterion measure is perhaps the biggest limitation. In general, medical records are considered the gold standard for measures of health service utilization, particularly for hospital-based services such as emergency room visits and inpatient hospitalizations. Administrative claims files such as MMIS are created to track billings and paid amounts, not to capture units of hospitalizations or emergency visits, or to serve research purposes generally. Previous research has examined the concordance of Medicaid or Medicare databases and medical record information on diagnoses and several types of outpatient services, and has had mixed findings, depending upon the diagnosis and the service[57,58] although some improvements in validity have been seen over time[59].

To our knowledge there is limited research on the validity of extracting hospitalization and emergency room visit counts from Medicaid databases of paid claims. The most pertinent study we are aware of examined six Medicaid databases for likely errors in capturing hospitalizations and found that for all of the databases there appeared to be some missing hospitalizations for persons with Medicare[60]. Among persons self-reporting hospitalizations or emergency room visits in our study, 43% did not have a paid claim for any utilization in MMIS, which leads us to think that there may be missing hospital-based utilization (both inpatient and emergency room) in our state MMIS data. We did not have reliable information on additional health insurance, including Medicare and private insurance, which we could have used to adjust for possible validity problems

with our criterion measure. However, we do not have any reason to believe that utilization would be differentially missing from the state MMIS database for persons with and without depressed mood.

A related concern is the very high overreporting of emergency room visits in our study, which may result from missing or miscoded claims data in the state MMIS database, as mentioned above. Another possible explanation is that despite the wording of the survey question, which asked specifically about hospital emergency room use, respondents may have reported as emergency room visits some health care encounters that took place outside hospital emergency rooms in urgent care clinics or other settings. If persons with depressed mood are more likely to mistakenly report an urgent care clinic visit as a hospital emergency room visit, this could account for the relationship between depressed mood and greater overreporting of emergency room utilization. Unfortunately, we do not have detailed claims data about non-hospital health service utilization, and are unable to examine this hypothesis further. A third possible explanation is that persons who overreported emergency room visits went to the emergency room but did not stay long enough to receive services, resulting in no claim for the visit. If persons with depression were more likely to leave emergency rooms before receiving services, this could underlie the observed relationship between depressed mood and greater overreporting of emergency room visits. However, we do not have any reason to think this is the case, and if hospitalizations or emergency room visits are missing from our criterion measure, but not related to depressed mood status, this missing information should reduce the power of our analyses but not invalidate our findings related to depressed mood and overreporting.

Our final limitation is our measure of depressed mood. Our study would have been strengthened by the use of a validated survey instrument measuring depression or depressed mood at the time of the survey rather than during the previous month, and future research may want to include such instruments to explore further the relationship between depressive symptoms and self-reports. However, an advantage of our study is that we did not rely upon depression diagnoses from administrative data to establish depressed mood at the time of the survey, but linked our administrative data to a survey instrument with a question reporting recent days of sadness or depressed mood.

### *Conclusions*

We believe that our study is the first comparison of self-reports and computerized Medicaid fee-for-service claims data for hospitalizations and emergency room visits, and one of very few studies to explore associations between depressed mood and overreporting of health service utilization. Our comparison of self-reports and computerized claims data for disabled Medicaid enrollees found that, compared to paid claims data, self-reported health service utilization overstated the number of emergency room visits and hospitalizations. We suggest that state Medicaid staff should not rely upon enrollee self-reports to represent the number of emergency room visits and hospitalizations found in fee-for-service paid claims, as the two are not comparable. Furthermore, policy makers and researchers should be cautious about relying upon self-reported estimates of health service utilization provided by populations with high burdens of physical disability or depression, such as the population of this study. Our second major finding was that recent depressed mood increased the number of emergency room overreports by 37%, and was associated with overreporting hospital room nights by one

to seven days. While recent research in this population indicates that a claims diagnosis or survey self-report of depression is associated with increased odds of making a non-mental health-related emergency room visit (Wieland, unpublished, 2008), current depressed mood in persons with depression might well exaggerate the magnitude of excess health service utilization if the data on utilization is self-reported. Investigators using self-reports of utilization to assess the relationship between health service utilization and depression should be aware of this potential for overstating the relationship between depression and increased utilization. Additional studies with larger sample sizes, varied criterion measures and better measurements of depressed mood should be carried out to confirm our findings and investigate this issue further.

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Figure 1: Identification of Analytic Sample

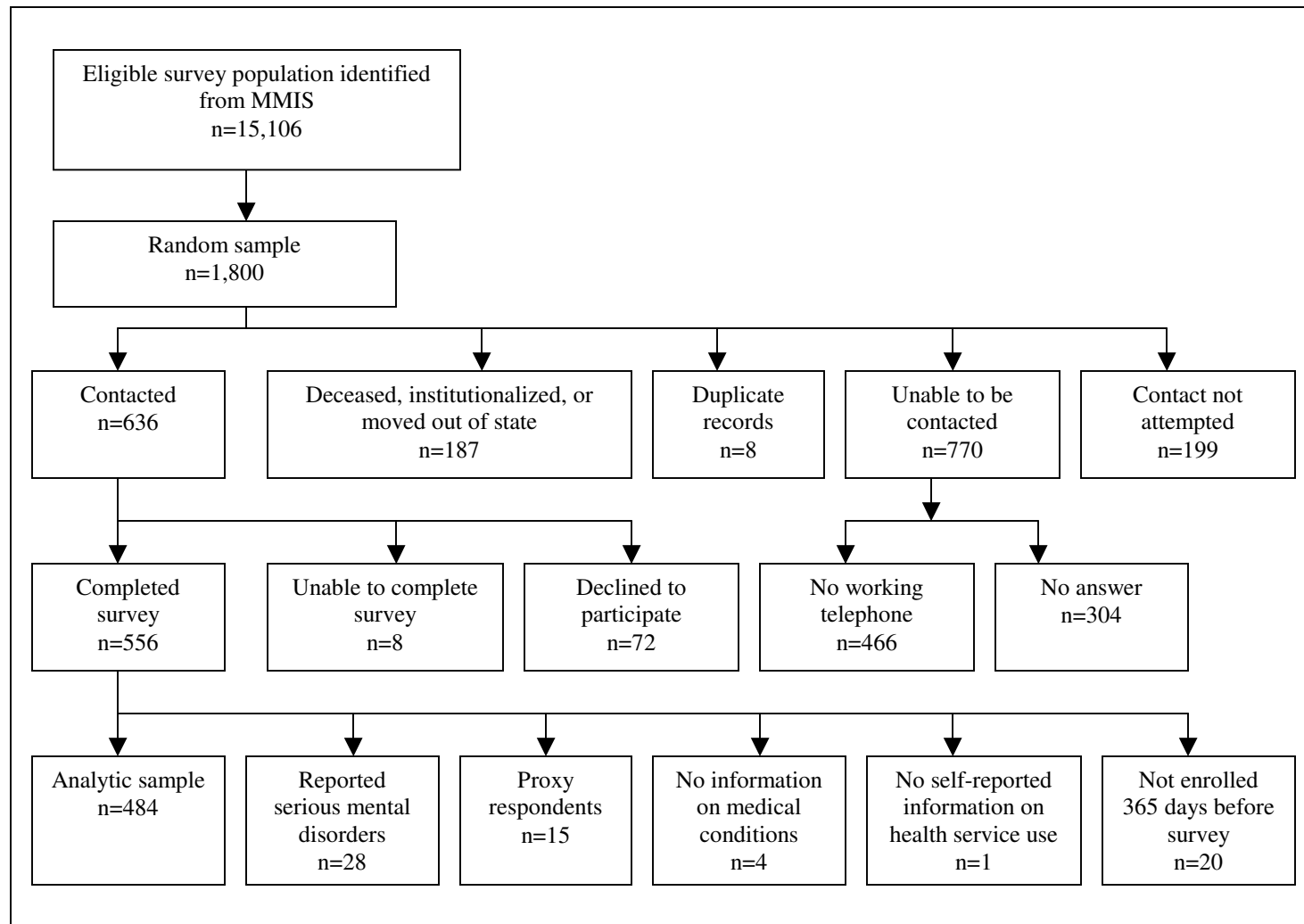
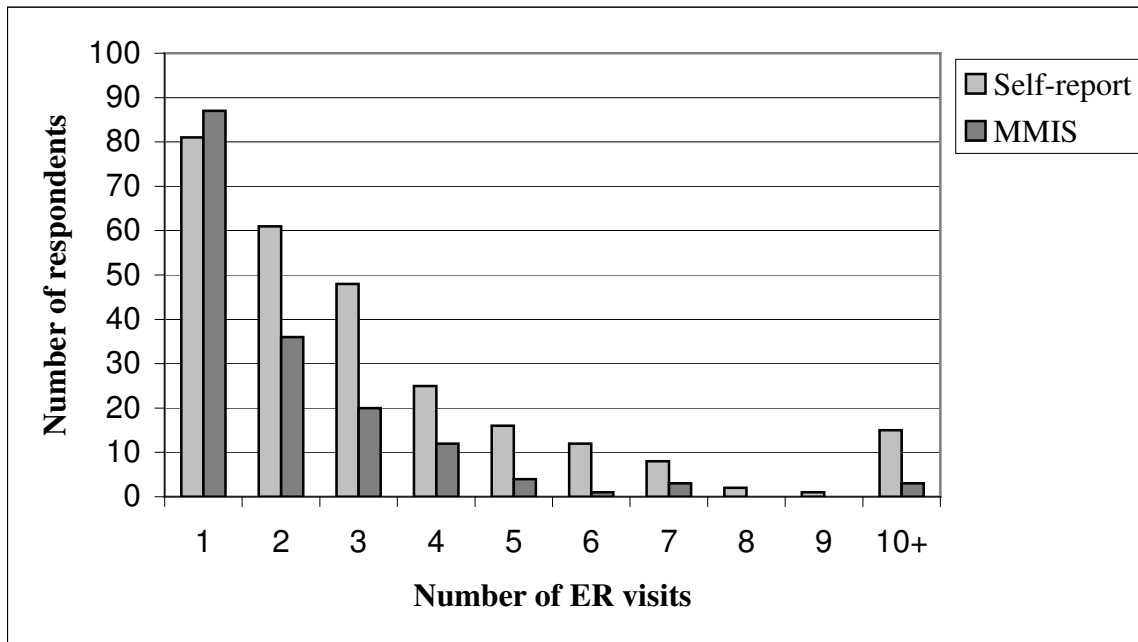


Figure 2: Survey Questions on Health Service Utilization

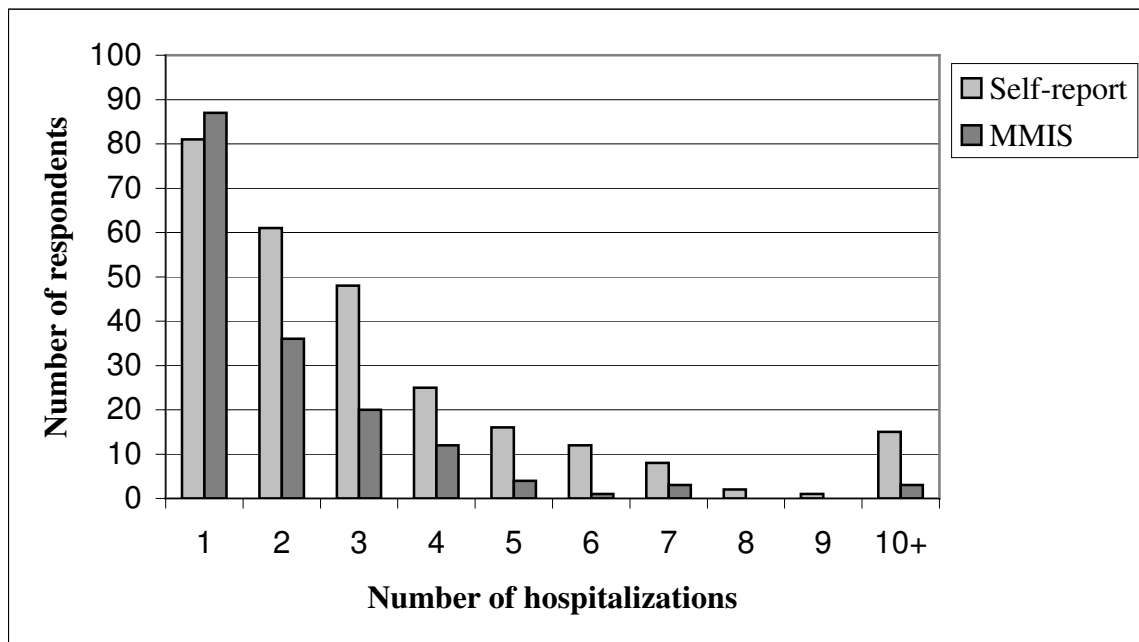
|      |                                                                                                       |
|------|-------------------------------------------------------------------------------------------------------|
| Q.55 | In the past year, how many times have you gone to a hospital emergency room?    __ __                 |
| Q.56 | In the past year, how many times have you been admitted to the hospital? [If none, go to 58]    __ __ |
| Q.57 | In the past year, how many nights did you spend in the hospital?    __ __                             |

Figure 3: Number of Emergency Room Visits by Data Source\*



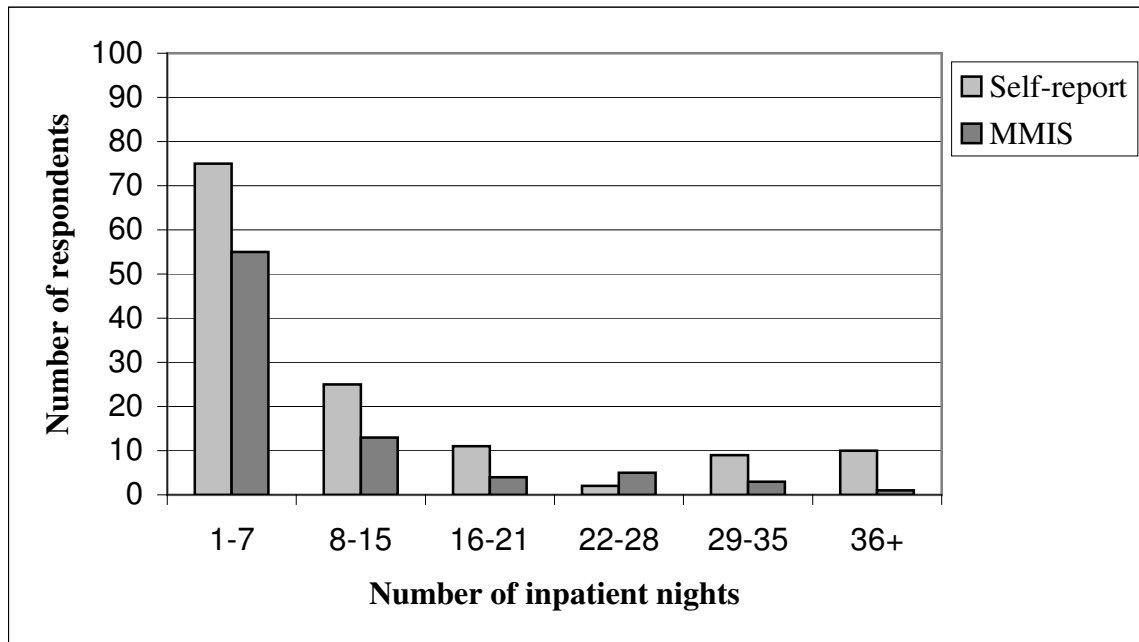
\*Not including persons reporting no emergency room visits

Figure 4: Number of Hospitalizations by Data Source\*



\* Not including persons reporting no hospitalization

Figure 5: Number of Inpatient Nights by Data Source\*



\*Not including persons reporting no hospitalization

Table 1. Characteristics of the Survey Sample

|                               | <b>Recent<br/>depressed<br/>mood<br/>N=247</b> | <b>No recent<br/>depressed<br/>mood<br/>N=237</b> | <b>Total sample<br/>N=484</b> | <b>Statistical test</b> |
|-------------------------------|------------------------------------------------|---------------------------------------------------|-------------------------------|-------------------------|
|                               | <b>Mean (sd)</b>                               | <b>Mean (sd)</b>                                  | <b>Mean (sd)</b>              | <b>t (p)</b>            |
| <b>Age</b>                    | 49.90 (10.17)                                  | 48.60 (11.89)                                     | 49.26 (11.05)                 | 1.30 (0.19)             |
|                               | <b>N (%)</b>                                   | <b>N (%)</b>                                      | <b>N (%)</b>                  | <b>Chi-square (p)</b>   |
| <b>Sex</b>                    |                                                |                                                   |                               |                         |
| <b>Female</b>                 | 163 (65.99)                                    | 144 (60.76)                                       | 307 (63.43)                   | 1.43 (0.23)             |
| <b>Race</b>                   |                                                |                                                   |                               |                         |
| <b>White</b>                  | 172 (69.64)                                    | 164 (70.39)                                       | 336 (70.00)                   | 6.42 (0.09)             |
| <b>Hispanic</b>               | 42 (17.00)                                     | 30 (12.88)                                        | 72 (15.00)                    |                         |
| <b>Black</b>                  | 15 (6.07)                                      | 27 (11.59)                                        | 42 (8.75)                     |                         |
| <b>Other</b>                  | 18 (7.29)                                      | 12 (5.15)                                         | 30 (6.25)                     |                         |
| <b>Education</b>              |                                                |                                                   |                               |                         |
| <b>Less than high school</b>  | 124 (50.41)                                    | 99 (41.77)                                        | 223 (46.17)                   | 3.93 (0.14)             |
| <b>Completed high school</b>  | 63 (25.61)                                     | 76 (32.07)                                        | 139 (28.78)                   |                         |
| <b>Attended any college</b>   | 59 (23.98)                                     | 62 (26.16)                                        | 121 (25.05)                   |                         |
| <b>Other health insurance</b> |                                                |                                                   |                               |                         |
| <b>Additional insurance</b>   | 57 (23.27)                                     | 74 (31.62)                                        | 131 (27.35)                   | 4.21 (0.04)             |
| <b>General Health Status</b>  |                                                |                                                   |                               |                         |
| <b>Good or better</b>         | 33 (13.41)                                     | 77 (32.49)                                        | 110 (22.77)                   | 24.97 (<0.0001)         |
| <b>Fair or poor</b>           | 213 (86.59)                                    | 160 (67.15)                                       | 373 (77.23)                   |                         |

Note: Age and sex were obtained from the enrollment files, and all other variables were obtained from survey self-reports.

Table 2 Distributions of difference between utilization counts for survey self-report and MMIS (SR-MMIS) for respondents with and without recent depressed mood\*

| <b>Differences<br/>(SR-MMIS)</b> | <b>Recent<br/>depressed mood<br/>N=247 (%)</b> | <b>No recent<br/>depressed mood<br/>N=237 (%)</b> | <b>Total<br/>N=484* (%)</b> |
|----------------------------------|------------------------------------------------|---------------------------------------------------|-----------------------------|
| <b>ER visits</b>                 |                                                |                                                   |                             |
| <b>-3</b>                        | 2 (0.82)                                       | 1 (0.42)                                          | 3 (0.63)                    |
| <b>-2</b>                        | 2 (0.82)                                       | 3 (1.27)                                          | 5 (1.04)                    |
| <b>-1</b>                        | 16 (6.56)                                      | 12 (5.08)                                         | 28 (5.83)                   |
| <b>0</b>                         | 109 (44.67)                                    | 124 (52.54)                                       | 233 (48.54)                 |
| <b>1</b>                         | 40 (16.39)                                     | 42 (17.80)                                        | 82 (17.08)                  |
| <b>2 - 3</b>                     | 42 (17.22)                                     | 38 (16.10)                                        | 80 (16.67)                  |
| <b>4+</b>                        | 33 (13.52)                                     | 16 (6.78)                                         | 49 (10.21)                  |
| <b>Hospitalizations</b>          |                                                |                                                   |                             |
| <b>-2</b>                        | 1 (0.40)                                       | 1 (0.42)                                          | 2 (0.41)                    |
| <b>-1</b>                        | 4 (1.62)                                       | 2 (0.84)                                          | 6 (1.24)                    |
| <b>0</b>                         | 185 (74.90)                                    | 195 (82.28)                                       | 380 (78.51)                 |
| <b>1</b>                         | 32 (12.96)                                     | 23 (9.70)                                         | 55 (11.36)                  |
| <b>2 - 3</b>                     | 17 (6.88)                                      | 11 (4.64)                                         | 26 (5.37)                   |
| <b>4+</b>                        | 8 (3.26)                                       | 5 (2.11)                                          | 15 (3.10)                   |
| <b>Nights in hospital</b>        |                                                |                                                   |                             |
| <b>-20 - -8</b>                  | 1 (0.41)                                       | 1 (0.42)                                          | 2 (0.41)                    |
| <b>-2 - -7</b>                   | 6 (2.45 )                                      | 2 (0.84)                                          | 8 (1.66)                    |
| <b>-1</b>                        | 0 (0.00)                                       | 1 (0.42)                                          | 1 (0.21)                    |
| <b>0</b>                         | 170 (69.39)                                    | 189 (79.75)                                       | 359 (74.48)                 |
| <b>1</b>                         | 12 (4.90)                                      | 9 (3.80)                                          | 21 (4.36)                   |
| <b>2 - 7</b>                     | 37 (15.10 )                                    | 19 (8.02 )                                        | 56 (11.62)                  |
| <b>8+</b>                        | 19 ( 7.75)                                     | 16 (6.75)                                         | 35 (7.26)                   |

\* Because of missing self-reports for some questions, the self-report and difference sample for ER visits was n=480 and for hospital nights was n=482.

Table 3. Rate ratios for recent depressed mood and covariates on number of overreported encounters

|                                                            | <b>Overreporting of<br/>ER Visits<br/>RR (95% CI)</b> | <b>Overreporting of<br/>Hospitalizations<br/>RR (95% CI)</b> |
|------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------|
| <b>Report Recent Depressed Mood</b>                        | 1.37 (1.02 , 1.83)*                                   | 1.24 (0.80 , 1.92)                                           |
|                                                            |                                                       |                                                              |
| <b>Age</b>                                                 | 0.98 (0.97, 0.99)**                                   | 0.99 (0.96 , 1.01)                                           |
| <b>Sex (Female is reference)</b>                           |                                                       |                                                              |
| <b>Male sex</b>                                            | 0.89 (0.65 , 1.19)                                    | 0.93 (0.59 , 1.45)                                           |
| <b>Race/Ethnicity (White is reference)</b>                 |                                                       |                                                              |
| <b>Hispanic</b>                                            | 1.15 (0.79 , 1.74)                                    | 1.47 (0.82 , 2.62)                                           |
| <b>Black</b>                                               | 1.66 (1.03 , 2.69)*                                   | 0.72 (0.32 , 1.63)                                           |
| <b>Other</b>                                               | 1.14 (0.61 , 2.13)                                    | 1.32 (0.57 , 3.01)                                           |
| <b>Education (Less than high school is reference)</b>      |                                                       |                                                              |
| <b>HS Education</b>                                        | 0.91 (0.64 , 1.29)                                    | 0.77 (0.44 , 1.32)                                           |
| <b>College Education</b>                                   | 0.94 (0.65 , 1.35)                                    | 1.24 (0.73 , 2.12)                                           |
| <b>General Health Status (Good or better is reference)</b> |                                                       |                                                              |
| <b>Fair/Poor Health</b>                                    | 1.84 (1.25 , 2.71)**                                  | 1.79 (0.95 , 3.36)                                           |
|                                                            |                                                       |                                                              |
| <b>Have one or more visits in MMIS</b>                     | 2.15 (1.60 , 2.89)**                                  | 4.73 (2.97 , 7.51)**                                         |

\* p<0.05 \*\*p<0.01

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## Title

The effect of depression on non-mental health-related emergency department utilization in Medicaid enrollees with physical disabilities.

## Authors

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## Abstract

Background: Depression in the chronically ill contributes to morbidity, mortality and high levels of health service utilization. Physically disabled working-aged Medicaid enrollees are a population with a high prevalence of depression and high levels of health service utilization. However the effect of depression upon health service utilization in this population has not been examined.

Objective: To examine the association of depression and non-mental health-related emergency department visits and hospitalizations among working-aged physically disabled fee-for-service Medicaid enrollees.

Methods: We conducted a secondary analysis of paid claims data for emergency room visits and hospitalizations for 439 respondents to a 2001 Medicaid needs assessment telephone survey. Logistic regression analyses were used to compare any non-mental health-related utilization versus none and single versus multiple encounters in respondents with and without: 1) a claims diagnosis of depression, 2) a survey self-report of a depressive condition, and 3) either a claims diagnosis or a self-report of depression.

Results: Persons with a claims diagnosis of depression were more likely to have an emergency department visit (OR=2.28, 95% CI = 1.22, 4.26). Persons with a self-reported depressive condition trended towards greater odds of having at least one

emergency department visit (OR=1.41, 95% CI = 0.85, 2.35) and to have multiple emergency department visits (OR=1.71, 95% CI = 0.74, 3.98), although these relationships were not statistically significant at  $p < 0.05$ . There was no statistically significant relationship between depression and non-mental health-related hospitalization.

Conclusions: Our analysis suggests that depression is associated with higher non-mental health emergency department utilization in Medicaid recipients with physical disabilities. Further research is needed to assess whether depression may be a modifiable factor in efforts to reduce non-mental health utilization in this population.

## Introduction

Depression in the physically disabled or chronically ill is a significant contributor to morbidity and mortality<sup>1</sup>. Previous studies also suggest that depression is associated with increased rates of health service utilization in populations with chronic disease or physical disability<sup>2-9</sup>, and that most of this higher health service utilization is due to increased use of non-mental health services<sup>10,11</sup>.

Medicaid enrollees with physical disabilities are a high-cost subpopulation of Medicaid beneficiaries. While Medicaid enrollees with disabilities represented less than 20% of Medicaid enrollees in 2002, they accounted for 43% of expenditures<sup>12</sup>. Disability has also been the fastest growing Medicaid eligibility category, with an enrollment increase of 7.1% between 1990 and 1998 compared to an increase of 4.3% in total enrollment<sup>13</sup>. Increases in both Medicaid disability enrollment and Medicaid spending per disabled enrollee continued during the past decade<sup>14</sup>. Depression and other affective disorders are highly prevalent in Medicaid enrollees with physical disabilities<sup>15</sup>, but mental health treatment for them is often limited, since scarce public mental health resources are prioritized for enrollees with mental disorders<sup>16</sup>. Recent research has indicated that Medicaid enrollees with physical disabilities and recent depressed mood overreport the number of hospitalizations and emergency room visits during the previous year (Wieland, unpublished data, 2008). To our knowledge the relationship between depression and higher health service utilization has not yet been prospectively examined in this population. Meanwhile, recent research suggests that remission of depression symptoms is associated with decreases in general medical utilization<sup>17</sup>, although a systematic review of randomized trial evidence on the association between depression

treatment and reduction in health service cost in similar populations did not find significant cost savings (Wieland, unpublished data, 2008) . If there is a relationship between depression and higher levels of non-mental health service use among Medicaid enrollees with physical disabilities, then improved depression treatment may result in benefits for treated individuals without increased costs for the Medicaid program.

The objective of this study, therefore, was to determine if the relationship between depression and non-mental health service utilization observed in other populations is also true of the Medicaid population with physical disabilities. A unique dataset, containing two years of Medicaid paid claims data merged with data from a 2001 telephone needs survey of fee-for-service Medicaid enrollees with physical disabilities, allowed us to determine whether there was a relationship between a depression diagnosis during the first year and non-mental health service utilization during the second year, while controlling for potential confounders such as education, presence of limitations in activities of daily living (ADLs), and self-reported health status, among others.

Previous research indicates that depression is underdiagnosed in the medically ill<sup>18</sup> and that chronic conditions may not always be captured in administrative databases or paid claims<sup>19-21</sup>. For example, diagnostic information that is unnecessary for processing payments may not be recorded consistently<sup>22</sup>. Thus, even if Medicaid enrollees with depression are correctly diagnosed, claims data may not reflect this diagnosis. Therefore, in addition to testing the relationship between health service use and a claims-associated diagnosis of depression, we also test the relationship between health service use and a self-reported depressive condition, as captured in a needs assessment survey of a randomly selected sample of this population. Finally, because

depression may be underreported by survey respondents, we also examined the relationship between health service use and a depression measure that combines claims-associated depression diagnoses and self-reported depressive conditions.

### Methods

We used two data sources for our study. The first was the Health Care Needs of Adults with Disabilities Survey, a needs assessment telephone survey of Rhode Island (RI) working-age fee-for-service Medicaid enrollees with physical disabilities, conducted in March and April 2001 by the RI Medicaid Research and Evaluation Project<sup>15</sup>. The second source was a file containing enrollment data and paid medical claims for one year preceding and one year following the survey. This information was extracted from the state's computerized Medicaid Management Information System (MMIS) for each survey respondent. The two data sources were merged into a single dataset with survey, enrollment, and paid claims data for each survey participant. The study was approved by our university institutional review board.

#### *Survey participants and procedures*

The sampling frame for the needs assessment survey was the MMIS. All state fee-for-service Medicaid enrollees who were ages 21-64, enrolled during the period from October 1, 1999 to September 30, 2000, and living in the community were selected. Because the survey was intended to focus on Medicaid recipients with physical disabilities rather than mental disabilities, all persons identified as developmental disability waiver participants, or as receiving services restricted to persons with severe and persistent mental illness were removed from the sampling frame. Persons who had a claims-associated diagnosis of schizophrenia were also eliminated from the sampling

frame, but persons with other mental health diagnoses, such as depression or anxiety, remained within the sampling frame. The net eligible population identified from MMIS was 15,106 persons, from which a sample of 1,800 was randomly selected, a total of 636 were contacted, and 556 participated in the survey (see Figure 1). Respondents were asked about their health status, types and prevalence of health problems and conditions, access and barriers to health care, and unmet service needs. All surveys were conducted during March and April of 2001<sup>15</sup>.

#### *MMIS Data Files*

Medicaid administrative data for March 1, 2000 through May 31, 2002 were extracted from MMIS for all survey participants. The time window was selected to provide 365 days of claims data before the date of the first survey, and 365 days of claims data after the date of the last survey. The extract of administrative data included all outpatient, inpatient, and nursing home paid claims, as well as an enrollment file with starting and ending dates of Medicaid coverage segments.

#### *Measures*

##### *Depression diagnosis in paid claims*

Our criterion for depression diagnosis was a primary, secondary, or tertiary ICD9-CM code of 296.2 (major depression, single episode), 296.3 (major depression, recurrent episode), 300.4 (dysthymic disorder), or 311.0 (depressive disorder, not otherwise specified) in any of the outpatient, inpatient, or nursing home paid claims during the 365 days before the date of the survey.

##### **Depression based on survey information**

The telephone survey contained the following question: What health problems do

you have that require medical care or medication? We reviewed each response, and considered all responses of ‘depression’ or ‘depressive’ problems as reports of depression. Reports of ‘anxiety’, ‘stress’, ‘mood problems’, ‘emotional problems’ or ‘nerves’ were not counted reports of depression because they may reflect mental health diagnoses other than depression.

### *Health Service Utilization*

For each individual enrollee, claims for the year after the survey date were selected from administrative claims data. We focused our examination of non-mental health-related service utilization on hospital emergency department visits and inpatient hospitalizations because we wished to focus on utilization that is costly, possibly related to somatization or poor disease self-management, and thus perhaps potentially avoidable. A combination of claim type, bill type, and revenue code was used to identify claims for emergency department visits and inpatient hospitalizations, and the totals of emergency department visits, hospitalizations and nights in the hospital were counted. Emergency department visits that were followed within one day by a hospitalization were excluded from analysis, so that emergency department visits and hospitalizations were considered in separate analyses. For hospitalizations, we considered hospital claims with contiguous dates of service as part of a single hospitalization. The procedures followed in identifying and counting emergency department visits and hospitalizations were those developed and used by the state Medicaid staff and affiliated researchers in defining these events for monitoring and research purposes<sup>23</sup>.

We classified all emergency department visits and hospitalizations as mental health-related, or not mental health-related, based on the primary diagnosis associated

with the service. Specifically, if the primary diagnosis was an ICD9-CM code of 290 through 316, the utilization was classified as mental health-related, otherwise it was classified as non-mental health-related.

The focus of the study is on utilization and not costs, because the primary payer for acute care services, including physician and hospital utilization, by persons with dual enrollment in Medicare and Medicaid, is Medicare<sup>24</sup>. The Medicaid claims files contain dates and co-pay amounts for hospitalizations, but do not reflect total hospital costs for Medicaid enrollees who are dual eligible (receiving both Medicaid and Medicare). Thus, information on hospital-related costs is incomplete. A complete picture of costs would require merging Medicaid data with Medicare claims data, which is beyond the scope of this study.

#### *Other Variables*

Several survey questions captured respondent characteristics that have been examined in other studies for their relationship to health service use, particularly emergency department or hospitalization utilization<sup>25-27</sup>. Such information collected during the telephone survey included race/ethnicity (white, black/African-American, Spanish/Hispanic, or Other), education completed (less than high school, high school, more than high school), living conditions (living alone, living with others), general health status (excellent, very good, good, fair, or poor), presence or absence of ADL limitations, and self-reported individual health conditions, including asthma, diabetes, and heart conditions. The majority of respondents reported that they were white, so we classified race/ethnicity as white versus nonwhite. Very few participants reported good, very good or excellent health, so we categorized general health status into good or better versus fair

or poor.

Additional information from the MMIS enrollment files included age, sex, and enrollment periods for each participant.

### **Data Analysis**

We used univariate and multivariable logistic regression analyses to examine 1) the relationship between depression and any non-mental-health-related emergency department or hospital utilization in the Medicaid claims data, and 2) the relationship, among persons with any utilization, between depression and multiple versus single emergency department visits or hospitalizations. All univariate and multivariable analyses were conducted using Stata (Release 9, College Station, TX).

### **Results**

#### *Sample characteristics*

Although persons with developmental or other psychiatric disabilities were initially screened out of the sampling frame through specialty service use criteria, a few survey respondents without such service use reported developmental disabilities or serious mental illnesses such as bipolar disorder, schizophrenia, or other psychotic disorders. We eliminated these respondents (n=28) from analyses in order to maintain a sample of Medicaid enrollees with physical and not mental disabilities. We eliminated proxy respondents (n=15) from our study sample because they would not be able to provide self-reported information on depression. We also eliminated respondents with missing responses on the survey question requesting information on medical conditions (n=4), as this question was used to identify a self-reported depressive condition.

Respondents who were not documented on the enrollment file as enrolled for a full 12

months before the survey (n=20) were eliminated from the sample, because they would not have an equal chance to have a depression diagnosis registered in the MMIS. We also eliminated survey respondents who were not documented on the enrollment file as enrolled in Medicaid for at least 347 days after the survey (n=50). After the exclusions described above the final sample included 439 respondents.

MMIS data on race, age, and sex indicated that survey respondents and enrollees in the sampling frame were similar in racial/ethnic distribution, but that the survey participants were more likely to be women (64% of this analytic sample versus 57% of those eligible) and to be older (52% of the analytic sample aged 50-64 years, versus 43% of those eligible)<sup>15</sup> The analytic sample was not significantly different in age, sex, or racial/ethnic distribution from those survey respondents excluded on the basis of missing data (n=74).

See Table 1 for characteristics of the survey sample. A depression diagnosis was present in the administrative files for 49 (11%) respondents, and depression was self-reported as a medical condition by 86 (20%) respondents. Altogether, 109 (25%) respondents had either a claims-associated diagnosis or a survey self-report of depression, and 26 respondents had both.

There were no significant differences in age, race/ethnicity, educational status, living situation, ADL status, general health status, or presence of asthma or diabetes between respondents with and without depression, by any depression criterion. Respondents with depression were much more likely to report at least 14 days of depressed mood in the previous month (OR=3.36, 95% CI (1.76, 7.19) for claims-associated diagnosis; OR=4.33, 95% CI (2.49, 7.53) for self-reported depressive

condition). Respondents with depression were also more likely to be female (OR=1.86, 95% CI (0.94, 3.39) for claims-associated diagnosis of depression, and OR=2.32, 95% CI (1.33, 4.03) for self-reported depressive condition), and less likely to report their race as Black (OR=0.15 (95% CI (0, 0.56) for claims-associated depression and/or self-reported depressive condition).

### *Utilization*

Over one-third of the sample had at least one non-mental health-related emergency department visit during the year following the survey, and almost one-fifth had at least one non-mental health-related hospitalization (see Table 2). Almost half of all respondents with any non-mental health-related emergency department visit had more than one trip to the emergency department (range 1-10 visits), and one-third of respondents hospitalized for non-mental health diagnoses were hospitalized more than once (range 1-18 hospitalizations).

### *Relationship between Depression and Hospitalization*

In univariate analyses, neither a claims diagnosis nor a survey report of depression was associated with having a non-mental health-related hospitalization (claims diagnosis OR=0.68, 95% CI 0.28-1.68); survey report OR=0.62, 95% CI 0.30-1.26); either claims diagnosis or survey report OR=0.62, 95% CI 0.33-1.18), and the results of multivariate analyses were similar (see Table 3). The small number of persons with multiple hospitalizations and depression made it impossible accurately to estimate an odds ratio for an association between depression and one versus multiple hospitalizations.

### *Relationship between Depression and Emergency Department Visits*

In univariate analyses, a claims diagnosis of depression was associated with having a non-mental health-related emergency department visit during the year after the survey (OR=1.99, 95% CI 1.09-3.62), and a survey report of depression was positively but not significantly associated with having a non-mental health-related emergency department visit (OR=1.32, 95% CI 0.81-2.14). When respondents with either a claims-associated diagnosis or a survey report of depression were compared to those with neither, the odds ratio for having an emergency department visit was smaller than that for persons with a claims-associated diagnosis alone, but was positive and close to statistical significance (OR=1.49, 95% CI 0.95-2.32). In each case, odds ratios increased after adjustment for age, sex, race/ethnicity, education, living situation, general health status, presence of ADLs, and presence of comorbid health conditions (see Table 3). Among the 151 respondents with at least one non-mental health-related emergency department visit, a claims-associated depression diagnosis was not associated with increased odds of having more than one visit (univariate OR=1.01, 95% CI 0.42-2.42). However, a self-reported depressive condition was positively associated with an increased odds of having more than one visit, although not at a statistically significant level (univariate OR=1.46, 95% CI 0.68-3.13). Multivariate results were consistent with univariate results (see Table 3).

### Discussion

In this sample of physically disabled fee-for-service Medicaid enrollees followed for one year, a claims-associated diagnosis of depression during the first year was associated with significantly greater odds of having a non-mental health-related emergency department visit during the second year. There were also trends toward an

association between a survey report of a depressive condition and having any emergency department visit as well as having multiple emergency department visits. Neither a claims-associated diagnosis of depression nor a survey reported depressive condition was associated with having a non-mental health-related hospitalization.

The results of this analysis are consistent with the findings of increased emergency department utilization in previous research in the elderly or medically ill with depression<sup>3,6</sup>. Previous research on associations between depression and hospitalization are mixed, and our results agree with studies finding that depression does not increase the risk of hospitalization<sup>28</sup>, including a study by Finkelstein et al., which demonstrated that among Medicare enrollees with diabetes a diagnosis of depression is associated with increased inpatient costs but does not increase the odds of an inpatient hospitalization<sup>29</sup>.

Previous studies have found that depression is associated with several factors that could potentially lead to increased emergency department or hospital utilization. Depressed persons are more likely than persons without depression to be smokers, to have poor diets, and to have low levels of physical activity<sup>30-32</sup>. These lifestyle factors could underlie the association between depression and poor health, which in turn leads to greater need for hospitalization and emergency department services. Depression is also associated with poor adherence to medication and medical advice<sup>33 34-36</sup>, and in persons with a chronic disease, such noncompliance could lead not only to overall poorer health but also to medical crises that lead directly to emergency department use. Finally, depression is also associated with somatization, the expression of psychological distress through physical symptoms, which may cause persons to seek emergency department care even when there is not an evaluated medical need for this service<sup>37</sup>.

Our finding that emergency department utilization, but not hospitalization, was associated with depression should be viewed in the light of the characteristics of these two types of utilization. Hospitalizations are determined by evaluated medical need, and aside from some elective procedures, not by patient choice. Emergency department visits, on the other hand, are driven by a complex blend of acute medical need, characteristics of the health care environment, and patient decision-making, allowing depression to have a more direct effect on utilization. Both emergency department visits and hospitalizations may also be driven by lack of appropriate primary care, resulting in potentially avoidable emergency department visits and hospitalizations, reflected in the concepts of ambulatory care sensitive (ACS) hospitalizations<sup>38</sup> and potentially preventable emergency department visits<sup>39</sup>. Depression, which is often characterized by hopelessness and apathy, may cause patients to postpone or neglect appropriate primary and preventive care. Previous research has established that elderly Medicare recipients with chronic illness and depression are significantly more likely to have an ACS hospitalization or emergency department visit<sup>6,7,10</sup>. It is possible that there is a similar relationship between depression and ACS hospitalization in working-age Medicaid enrollees with physical disabilities, however our sample size did not allow us to test for this association.

We found that a claims-associated depression diagnosis was not associated with multiple non-mental health-related emergency department visits but a self-reported depressive condition was positively albeit not significantly associated with multiple visits. This suggests that claims-associated depression and a self-reported depressive condition are measuring different constructs. Perhaps the presence of a claims diagnosis

is a reflection of successful interaction with a medical practitioner, and respondents with a claims-associated diagnosis are using the health system more effectively. These respondents may be making initial emergency department visits but not returning to the emergency department visit multiple times. Persons willing to self-report a depressive condition may be more likely to be suffering current psychological distress, and if this distress manifests as somatization, the result could be more frequent emergency department visits.

A limitation of this study is the use of administrative data to identify persons with depression, which has been shown to result in selection of a cohort with relatively severe and persistent depression<sup>40</sup>. Persons with a claims diagnosis of depression may be likely to engage with the health service system; thus, since we do not have an indication of incident depression, it is not possible to know whether the presence of a claims diagnosis is a cause or a result of patterns of higher service use. Some survey respondents with depression may have failed to self-report that depression was one of their medical conditions, either because of oversight or stigma<sup>41</sup>, while respondents without a depressive condition may have reported depression as a result of a transient depressed mood state. The implication is that self-reports of depressive conditions may include both false positives as well as false negatives, biasing our estimate of an association between depression and health service utilization towards the null. We combined claims-associated and self-reported depressive conditions in order to account for difficulties in ascertaining depression status, but we are unable to confirm whether any study participants were suffering from current, symptomatic depression during the time period of the study. Our study is also subject to the standard limitations of surveys, especially

with respect to having a phone as a source of bias. Over 400 Medicaid enrollees with whom contact was attempted did not have a working telephone, and the relationship between depression and utilization in this group may be different from that in the sample that was eventually contacted. Finally, this study is also limited by lack of information on the reliability of the MMIS claims for hospitalizations. Previous research has suggested that hospitalization information is sometimes missing from state Medicaid files for Medicare enrollees<sup>42</sup>. However, we do not have any reason to believe that Medicare eligibility is more common in enrollees with depression. If hospitalizations and emergency department visits were missing at random from our data, our results would be biased towards the null and our results would underestimate the relationship between depression and non-mental health-related utilization.

### Conclusions

In this sample of Medicaid enrollees with physical disabilities, 95% (284/299) of all emergency department visits were non-mental health-related, and a depression diagnosis (either in paid claims or in a survey self-report, or both) was associated with making a non-mental health-related emergency department visit. If depression were better managed in this population, through improved mental health treatment and coordination of medical and mental health services, it remains possible that non-mental health emergency department utilization might be reduced. This potential reduction in non-mental health-related utilization, combined with a reduction in mental-health-related emergency department and hospital utilization resulting from better outpatient management of depression, could lead to overall reductions in hospital-related utilization and associated costs. The potential for cost-savings for Medicaid programs, as well as

the potential for improved mental health in Medicaid enrollees with physical disabilities, warrants further research on relationships between depression, depression treatment, and health service utilization in Medicaid populations.

## **Acknowledgments**

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Figure 1: Identification of Analytic Sample

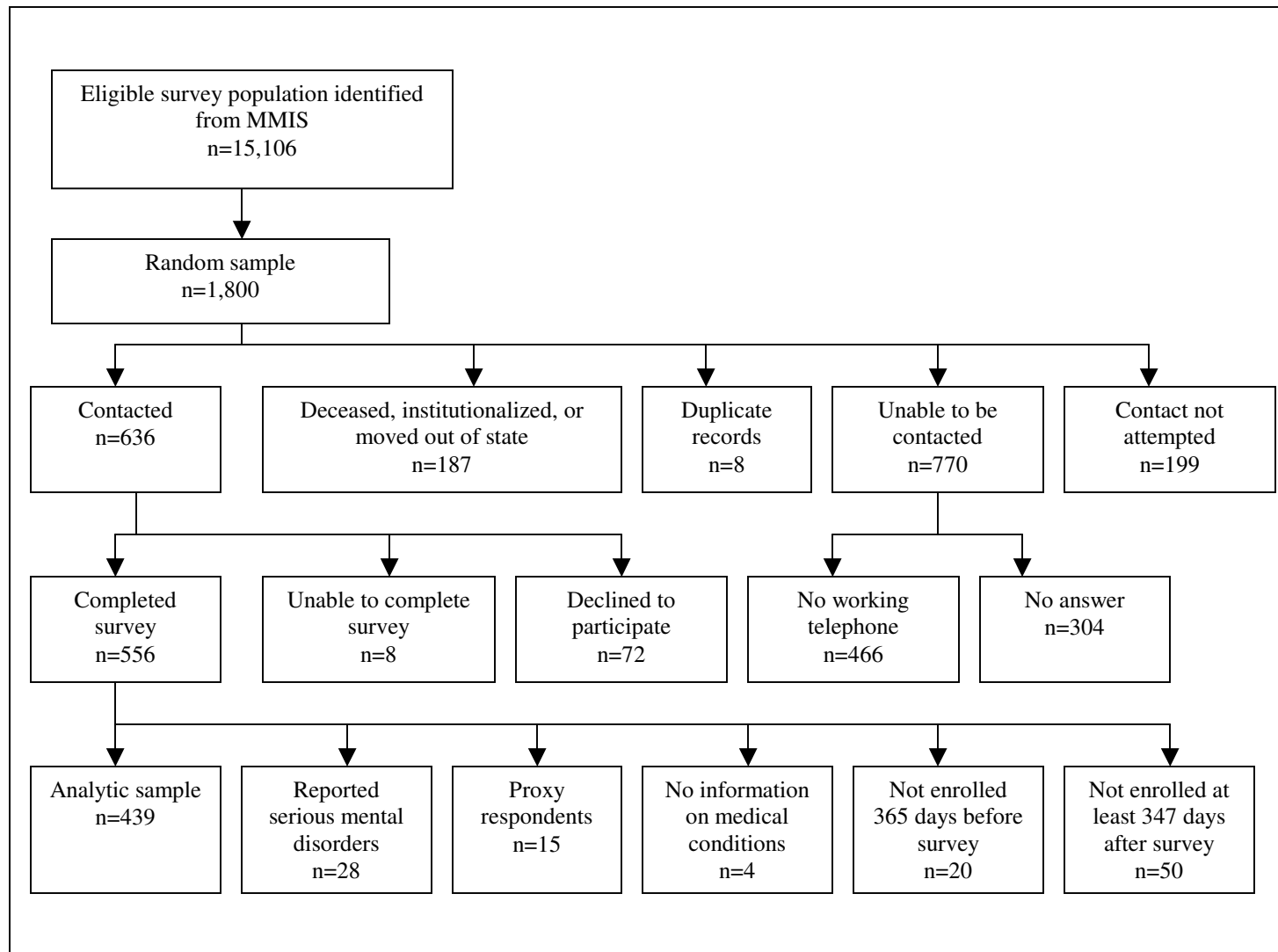


Table 1: Sample characteristics

|                                                        |                               |
|--------------------------------------------------------|-------------------------------|
| <b>acteristics</b>                                     | <b>Total sample<br/>N=439</b> |
|                                                        | <b>Mean (sd)</b>              |
| <u>Age in years</u>                                    | 49.39 (10.99)                 |
|                                                        | <b>N (%)*</b>                 |
| <u>Sex</u>                                             |                               |
| Male                                                   | 159 (36.22)                   |
| Female                                                 | 280 (63.78)                   |
| <u>Race</u>                                            |                               |
| White                                                  | 297 (68.12)                   |
| Black/African American                                 | 39 (8.94)                     |
| Hispanic                                               | 73 (16.74)                    |
| Other                                                  | 27 (6.19)                     |
| <u>Education</u>                                       |                               |
| Less than high school                                  | 206 (47.03)                   |
| Completed high school                                  | 130 (29.68)                   |
| Attended any college                                   | 102 (23.29)                   |
| <u>Living Situation</u>                                |                               |
| Lives alone                                            | 189 (43.05)                   |
| Lives with others                                      | 250 (56.95)                   |
| <u>General Health Status</u>                           |                               |
| Excellent to Good                                      | 96 (21.92)                    |
| Fair to Poor                                           | 342 (78.08)                   |
| <u>Limitations in Activities of Daily Living (ADL)</u> |                               |
| No ADLs                                                | 274 (62.41)                   |
| At least one ADL                                       | 165 (37.59)                   |
| <u>Self-reported medical conditions</u>                |                               |
| Asthma                                                 | 60 (13.67)                    |
| Diabetes                                               | 93 (21.18)                    |
| Heart Conditions                                       | 174 (39.64)                   |

\*Percentages based on available data

Table 2: Depression Status and Non-Mental Health-related Emergency Department (ED) Visits and Hospitalizations

| <b>Depression status</b>                                      | <b>Persons making any ED visit<br/>N (%)</b> | <b>Persons making more than one ED visit<br/>N (%)</b> | <b>Persons having any hospitalization<br/>N (%)</b> | <b>Persons having more than one hospitalization<br/>N (%)</b> |
|---------------------------------------------------------------|----------------------------------------------|--------------------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------|
| <b>Claims diagnosis of depression</b>                         | 24 (15.89)                                   | 11 (15.94)                                             | 6 (8.33)                                            | 4 (16.00)                                                     |
| <b>Survey report of depression</b>                            | 34 (22.52)                                   | 18 (26.09)                                             | 10 (13.89)                                          | 6 (24.00)                                                     |
| <b>Either claims diagnosis or survey report of depression</b> | 45 (29.80)                                   | 24 (34.78)                                             | 13 (18.06)                                          | 8 (32.00)                                                     |
| <b>Total in sample</b>                                        | 151 (100.00)                                 | 69 (100.00)                                            | 72 (100.00)                                         | 25 (5.69)                                                     |

**Table 3. Odds Ratios for Models Estimating Association between Depression and Non-Mental Health Service Utilization<sup>†</sup>**

| <b>Covariates</b>                                                               | <b>Any emergency department visit<br/>OR (95% CI)</b> | <b>More than one emergency department visit<br/>OR (95% CI)</b> | <b>Any hospitalization<br/>OR (95% CI)*</b> |
|---------------------------------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------|
| <b>Claims-associated diagnosis of depression</b>                                | 2.30 (1.23, 4.32)                                     | 0.94 (0.35, 2.50)                                               | 0.69 (0.28, 1.73)                           |
| <b>Survey report of depressive condition</b>                                    | 1.40 (0.84, 2.34)                                     | 1.61 (0.68, 3.80)                                               | 0.59 (0.28, 1.24)                           |
| <b>Claims-associated diagnosis and/or survey report of depressive condition</b> | 1.66 (1.03, 2.68)                                     | 1.77 (0.78, 4.00)                                               | 0.60 (0.31, 1.18)                           |

<sup>†</sup>All estimates adjusted for age, sex, race/ethnicity, education, living situation, general health status, presence of ADLs, and presence of asthma, diabetes, or heart conditions.

\*The number of survey respondents with multiple hospitalizations was too small to estimate odds ratios for relationship between depression and multiple hospitalizations.

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## Title

Systematic Review of the Effects upon Health Service Utilization and Costs of Depression Treatment in Adults with Chronic Physical Disease or Disability

## Authors

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## Abstract

**Objectives:** We conducted a systematic review of randomized controlled trials of depression treatment in persons with chronic physical diseases or disabilities in order to estimate whether treatment of depression in this population leads to reductions in health service utilization and costs.

**Methods:** We searched MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials (CENTRAL) and other databases of published and unpublished medical literature for randomized trials conducted in populations with chronic physical diseases or disabilities, comparing depression treatment to placebo, usual care, or no treatment, and following participants for at least six months. Only trials that presented health service utilization outcomes (eg, hospitalizations) or cost (eg, total outpatient costs) were included in the review.

**Results:** We found a total of three eligible trials in persons with specific chronic diseases. Sample sizes were small. Two of the included studies compared depression care management to usual care in persons with diabetes, and assessed cost outcomes at the end of 24 months. A third trial compared sertraline to placebo in patients with heart disease, and reported health service utilization and estimated direct medical costs after six

months. All trials showed minor, but not statistically significant differences between randomized groups in cost or utilization outcomes. We pooled the cost estimates from two studies of collaborative care versus usual care in persons with diabetes, and the overall estimate showed no statistically significant evidence of net cost savings.

Conclusions: Evidence from trials of depression treatment in populations with a diabetes or heart disease, and testing either active pharmacological treatment versus placebo or depression care management against usual care, suggest that depression treatment does not result in net increases in health service utilization and costs. However, randomized trial evidence on these outcomes is limited in size and number and probably insufficient to establish whether there are meaningful reductions in health service utilization and costs. Collection and reporting of cost and utilization outcomes should be considered when trials of depression treatment are conducted in populations with chronic disease or disability.

## Introduction

The prevalence of depression among persons with physical disabilities or chronic medical problems varies, although it is generally estimated to be substantially higher than among persons in the general population<sup>1-16</sup>. Several studies in the medically ill have shown that both morbidity and mortality are increased in the presence of depression<sup>3,17-21</sup> and that depression is also associated with elevated levels of general health service utilization in persons with physical illnesses<sup>20,22-29</sup>. The high prevalence of depressive disorders, and their association with disability, poor quality of life, and increased morbidity and mortality highlight the importance of effective depression treatment in the chronically ill or disabled, and previous research has established that depression treatment in the medically ill can be safe and efficacious<sup>30-32</sup>.

Because depression is associated with high levels of non-mental health utilization, it has long been hypothesized that effective depression treatment might reduce non-mental health service utilization<sup>33</sup>; the hope is that resultant cost savings might offset the costs of providing depression treatment and even provide a net savings to those paying for health care<sup>32,34</sup>. Observational evidence supports the relationship between improvement in depression symptoms and decreases in non-mental health utilization and overall health care costs across a range of populations<sup>35-37</sup>. The cost effects of depression treatment have been tested in some randomized trials in general primary care populations, and these have generally found that depression treatment is cost effective but does not result in cost savings or reduced health service utilization<sup>38-49</sup>. One reason for the lack of evidence on cost savings is that individual trials are commonly powered to detect changes in depression outcomes rather than health service utilization or cost

outcomes, and so separately they lack adequate power to detect differences in utilization or cost outcomes. However, a recent meta-analysis of cost outcomes for depression treatment in primary care populations found that while depression treatment is cost-effective, it is unlikely to provide cost savings in this population<sup>50</sup>.

It has been suggested that reductions in health service utilization or costs after depression treatment may be more likely to be found in studies of niche populations with a high prevalence of depression and a likelihood of continued high levels of health service utilization<sup>34</sup>. One such population is persons with physical disabilities or chronic medical conditions, since they have a high prevalence of depression and also markedly higher levels of health service utilization and costs than the general population. For example, if high levels of health service utilization among persons with chronic physical problems and depression are due to the interference of depression with self-management of the physical health condition, and successful treatment of depression improves self-management, health service use should decrease. Recent reports of participants with diabetes in depression treatment trials have focused on cost-effectiveness outcomes<sup>51,52</sup> and have found that, compared to usual care, systematic depression treatment provides cost savings, although not the savings are small and not statistically significant.

To our knowledge, there has not yet been a systematic review of randomized trials focusing on the cost savings effects (through reduced health service utilization or reduced health service costs) of depression treatment in populations with chronic medical conditions or disabilities. We believe that populations with physical disabilities or chronic diseases may be more likely to show such cost savings. We know that Medicaid enrollees with physical disabilities and depression are more likely to have non-mental

health-related emergency room visits than similar enrollees without depression (S. Wieland, unpublished data, 2008). Policy makers (eg state Medicaid programs) responsible for managing the costs of health care for populations with high burdens of chronic disease need to know the current state of the evidence in this area. Our objective was to systematically review the available randomized trial evidence to examine the associations between depression treatment and reduction in health service utilization and costs in persons with specific physical disabilities or chronic medical conditions and concurrent depression.

## Methods

### *Inclusion criteria*

We included trials with adult participants (aged 18 years or more) who had a specified physical disability (e.g., vision loss) or chronic medical illness (e.g., diabetes), who had been diagnosed as depressed or had a high burden of depressive symptomatology by any criteria, and who were randomized to active depression treatment versus placebo, usual care, or no treatment. We did not restrict inclusion to trials with participants diagnosed with major depression because there is evidence that subthreshold disorders are disabling and may affect health service utilization<sup>53,54</sup>. We excluded trials with participants who had depression coexisting with other serious psychiatric illnesses, including substance abuse disorders. However, because of the high co-morbidity of depression and anxiety, studies with participants who had both depression and anxiety were not excluded from the review.

We included studies with any type of treatment specifically intended to treat depression, including but not limited to antidepressant medication, psychotherapy, or

depression care management. We did not include psychosocial treatments aimed at improving general coping with or management of a disease condition. Treatment itself could be of any duration, but we included only studies that followed participants for at least six months, since we consider this to be the shortest reasonable length of time to observe any effects of depression treatment upon patterns of health service utilization and costs.

In order to be included in this review, studies had to report at least one outcome related to health service utilization or health care costs, including but not limited to the following outcomes: emergency room visits, hospital admissions, hospital length of stay, physician visits, and costs of health services.

#### *Search strategy*

In October 2007, we searched the following electronic databases: MEDLINE; EMBASE; PsycINFO; The Cochrane Central Register of Controlled Trials (CENTRAL); Database of Abstracts of Reviews of Effectiveness (DARE); Science Citation Index; Social Sciences Citation Index; Sociological Abstracts; and ProQuest Dissertations and Theses. We used the text word search strategy shown in Box 1 to search PubMed for MEDLINE references. This search strategy searches titles, abstracts, and keywords in PubMed. The strategy was adapted to search the other databases listed above.

Box 1.

|                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------|
| (depression OR depressive OR depressed) AND (treatment OR therapy) AND (utilization OR service* OR cost OR costs) AND (random*) |
|---------------------------------------------------------------------------------------------------------------------------------|

We did not hand search specialist conference proceedings or journals to identify additional randomized trials. However, the major biomedical journals have been

searched by Cochrane Schizophrenia Group (CSG) and Cochrane Depression, Anxiety and Neurosis Group (CDAN) and randomized or quasi-randomized trials identified for inclusion in CENTRAL<sup>55</sup>. Conference abstracts from some specialist conferences have also been hand searched for trials by CDAN, and trials identified from these proceedings have also been included in CENTRAL.

We reviewed the bibliographies of all included trials to identify potential additional trials, and reviewed the bibliographies of all excluded reports, if they were excluded solely on the basis of no reported utilization or cost outcomes, to identify additional possibly relevant trial reports, including unpublished reports and reports of ongoing trials. We also reviewed the contents of all retrieved reviews of cost-effectiveness or cost-offset of depression treatment, and all retrieved reviews of depression treatment in populations with chronic disease or disability, to identify additional possibly relevant trials.

### *Selection of studies*

Trial eligibility was assessed using the eligibility criteria described above, including population, intervention, principal outcomes, and study design. We did not restrict report eligibility by publication status or language of publication. The primary review author examined the titles and abstracts (where available) of all articles identified by the literature search for eligibility based on the inclusion and exclusion criteria specified above. The full text of all studies identified by the primary author as potentially relevant was obtained and independently reviewed by the primary author and the second author (PP). If there were disagreements between the authors with respect to a study's

eligibility for inclusion in the review, the authors discussed the issue and came to agreement. All decisions about study inclusion or exclusion were documented.

#### *Data extraction and assessment of study methodology*

Data on participants, interventions, comparisons, and outcomes were independently extracted by the first two authors. Any disagreements were discussed and resolved, and decisions were documented. The first author also used the Cochrane Collaboration risk of bias tool to assess the risks of bias in each of the included trials<sup>56,57</sup>. The Cochrane risk of bias tool assesses study conduct in six methodological domains that are associated with bias in study findings: sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting and ‘other issues’. The adequacy of each domain is assessed for each study, such that a judgment of “Yes” indicates that there is low risk of bias from this methodological domain for the study, “No” indicates that there is high risk of bias, and “Unclear” indicates uncertain risk of bias. Information on risk of bias was collected from the included study report and, when available, any additional study reports describing the design and conduct of the trial.

#### *Data analysis*

Our primary focus was the narrative comparison and discussion of study results. We planned to describe and discuss the overall findings of retrieved studies, and to perform subgroup comparisons by specific depression treatment and type of chronic disease or disability. To the extent that similar individual studies presented information on the same health services or costs outcomes, we planned to follow the recommendations of the Cochrane Collaboration’s Handbook in combining the data across studies. We intended to use Mantel-Haenszel random effects methods to estimate

the summary risk ratio for dichotomous outcomes (eg, any hospitalization), and random effects inverse variance methods to estimate the mean difference for continuous outcomes (eg, direct costs)<sup>57</sup>. In cases where standard deviations from means were unavailable but there was information on confidence intervals, we planned to use the methods outlined in Chapter 7 of the Cochrane Collaboration Handbook to calculate the standard deviations or standard errors from the means and confidence intervals<sup>57</sup>. We used the Cochrane Handbook to guide our decisions regarding metaanalyses, and Review Manager version 5.0 software to summarize data across studies<sup>57-59</sup>.

## **Results**

### *Identification of included trials*

After de-duplication of search results, the electronic literature searches retrieved a total of 5,888 records. An initial review of titles and abstracts resulted in the exclusion of 5,800 records because they were not reports of randomized trials, trial participants were not characterized with a specific disability or chronic illness, participants were not said to be depressed or with a high level of depressive symptomology, interventions were not described as intended to treat depression, there was clearly not a usual care, placebo or no treatment comparison group, or follow-up clearly did not extend to at least six months. For the remaining 88 records, full reports were obtained and independently reviewed by the first two authors (SW and PP). Sixty-seven of these records were excluded on the basis of study design, population, treatment, or duration of follow-up. Eighteen records were excluded solely because they did not contain relevant utilization or cost outcomes. These 18 records corresponded to reports from eight separate trials, one of them presently ongoing, and the characteristics of these trials are summarized in Table 1. The reference

lists of the 18 records without utilization or cost outcomes yielded three additional trial publications, but we failed to find any relevant outcome data in the additional references.

Three records met all inclusion criteria including the report of utilization or cost outcome data (see Figure 1). We searched the bibliographies of the three included trials, but did not find any additional references that appeared relevant to the review. We also failed to find additional relevant trials in the contents of retrieved reviews of costs and depression treatment, or reviews of depression treatment in the medically ill.

#### *Characteristics of included trials*

Characteristics of the included trials are summarized in Table 2. All three trials were conducted between 1997 and 2003. The trials were medium-sized, with the exception of the report from the IMPACT trial, which was a preplanned subgroup analysis of 418 participants with diabetes who were included in a trial of 1,801 elderly primary care patients with depression. Two of the trials (IMPACT and PATHWAYS) were conducted in the United States in outpatient populations with diabetes, and the third trial (SADHART) was carried out in patients with coronary disease attending clinics in North America, Europe and Australia.

Overall, the trials were assessed as having low risk of bias (see Table 3). The SADHART trial reports did not specify the method of randomization used, and the SADHART and PATHWAYS trial reports did not specify the methods used to conceal allocation to treatment groups, but blinding and follow-up were uniformly reported to have been conducted with low risk of bias, and all analyses were conducted as intent-to-treat. There were no other apparent sources of risk of bias, including systematic differences between groups in withdrawals from the trials, systematic differences in

exposure to factors other than the intervention, or other apparent problems in trial conduct or reporting.

### **Interventions and length of follow-up**

Two depression treatments were identified in the three trials. One trial (SADHART) randomized participants to sertraline versus placebo for six months, and followed patients for an additional month after the end of treatment. The other two trials randomized participants to systematic depression treatment programs versus usual care. The active conditions in IMPACT and PATHWAYS were stepped care programs providing therapy and/or medication, coordinated by specialist depression care managers, and delivered through outpatient visits and telephone contacts. These treatment programs consisted of up to 12 months of treatment contacts, with the content and intensity of contacts varying depending upon patient response to treatment. Follow-up was 24 months after randomization for both the IMPACT and PATHWAYS trials.

### *Assessment of health service utilization and costs*

See Table 4 for a summary of health service utilization and cost outcomes presented in each of the three included trials. The SADHART trial obtained data on emergency room visits and hospitalizations from adverse event forms completed during the seven months after randomization. IMPACT and PATHWAYS did not publish data on utilization.

All three trials examined costs from the perspective of third-party payers, but each trial was conducted in a different health care environment, and used different methods to assess costs. The SADHART trial calculated payer cost outcomes for hospitalizations, emergency room visits, and cardiac procedures during the seven months after randomization, and included sertraline costs for the intervention group. However, it was

not possible for the trialists to obtain any actual cost data for the participants. Instead, costs outcomes were estimated based on the mean daily dose of sertraline taken by study participants randomized to active treatment, and 2001 Medicare fees for diagnosis-related groups (DRGs) corresponding to patient psychiatric and medical diagnoses for hospitalizations and emergency room visits. The SADHART authors argued that, even if it had been possible to obtain individual actual costs, the international nature of the study would have made use of actual costs problematic.

The PATHWAYS trial was conducted in 9 primary care practices belonging to Group Health Cooperative, a single mixed-model prepaid health plan in Washington and Idaho. PATHWAYS investigators used the health plan's computerized cost accounting system to collect the actual costs of services to the HMO. Intervention staff costs were calculated with actual salary and fringe benefits, plus 30% overhead. The primary cost outcome was the cost of total outpatient services during the entire 24 months of follow-up. Secondary analyses examined the first 12 months of outpatient costs, the second 12 months of outpatient costs, and the total cost of both inpatient and outpatient services over 24 months. Complete cost data were only available for the 288/329 (88%) study participants remaining enrolled in the health plan for the full 24 months of follow-up. An additional 35/329 (11%) participants contributed partial cost data, and the remaining participants disenrolled before the first follow-up assessment and so provided no cost data. Participants with complete and incomplete or missing cost data did not differ significantly in assignment to treatment or in any demographic or clinical variables<sup>52</sup>. Primary cost outcomes were based on participants with any cost data, while secondary cost outcomes included only participants with complete cost data.

IMPACT participants were attendees of 18 different primary care clinics that were part of eight different health care organizations across the United States, varying from academic group practices to health maintenance organizations, to VA medical centers<sup>60</sup>. IMPACT trialists calculated costs differently depending on the type of organization. Costs were calculated from cost-accounting data in capitated systems, and from revenue generated for provided services in fee-for-service systems<sup>49</sup>. The primary cost outcome was the cost of total outpatient services during the entire 24 months of follow-up, including primary and specialty care, urgent care and emergency visits, all medications, laboratory and X-ray costs. Intervention costs included the costs of providing intervention education materials, the costs of intervention staff, based on actual salary and fringe benefits, and 30% overhead costs. A secondary cost outcome was the total cost of all inpatient and outpatient services over the 24 months of follow-up. The study report did not specify the number of participants missing cost data, but did describe procedures for imputing missing cost data.

#### *Utilization outcomes*

For both rehospitalizations and ER visits during the SADHART trial, participants in the sertraline group were less likely than participants receiving placebo to have any utilization, but this difference was not statistically significant. There were fewer psychiatric or cardiovascular rehospitalizations in the sertraline group than in the placebo group, and this was close to statistical significance ( $p=0.054$ ). There were also fewer ER visits in the sertraline group, but this was not statistically significant. The sample size for the SADHART study was powered on depression outcomes rather than cost or utilization outcomes, and thus lack of statistical significance in the results is not surprising.

### *Costs outcomes*

In the SADHART trial, total estimated costs for hospitalizations, emergency room visits, and cardiac procedures at seven months were slightly lower in the sertraline group than the placebo group (see Table 4), but this difference was not significant.

The PATHWAYS study calculated outpatient depression and non-depression-related costs separately for the first and second years, and found that outpatient depression-related costs during the first year of follow-up were higher in the intervention group than in the usual care group (largely due to intervention costs), and remained slightly higher during the second year of the intervention. However, outpatient non-depression costs during the first year of follow-up were slightly lower in the intervention group, and became much lower during the second year of the intervention. When total depression and non-depression outpatient costs were examined as a whole, costs were approximately equal during the first year of follow-up but there was a cost-savings in the intervention group during the second year. This cost-savings was statistically significant in the unadjusted comparison between intervention and usual care groups, but after adjustment for age, sex, costs prior to randomization, and comorbidity, the difference was no longer significant at  $p < 0.05$  (see Table 4).

The IMPACT trial report presented outpatient mental health, outpatient non-mental health, inpatient mental health, and inpatient non-mental health costs separately for the full 24 months of follow-up (see Table 4 for outpatient and combined outpatient and inpatient costs at 24 months). In the IMPACT trial, the outpatient mental health costs (which included intervention costs) were higher in the intervention group, while outpatient non-mental health costs were lower in the usual care group, resulting in a small

total outpatient cost savings in the intervention group at 24 months. Both inpatient mental health and inpatient non-mental health costs were higher in the usual care group, resulting in a several-hundred dollar cost saving for the intervention group in total inpatient and outpatient costs at 24 months. However, this difference was not significant at  $p < 0.05$  (see Table 4). Total inpatient and outpatient costs were also reported separately for the first and second years of follow-up, revealing higher total inpatient and outpatient costs for the intervention group during the first year but a larger savings in total inpatient and outpatient costs for the intervention group during the second year (see Table 4).

### *Meta-analysis*

We considered it inappropriate to combine SADHART cost data with cost data from the IMPACT and PATHWAYS trials. Compared to the collaborative care trial participants, the SADHART trial participants have been diagnosed with a different chronic disease, are located in multiple US and European locations with different health care systems and care patterns, and are randomized to very different interventions. Furthermore, the cost data in the SADHART trial were estimates rather than actual costs.

It is more appropriate to combine the results of the IMPACT and PATHWAYS trials using meta-analysis. Although the age and sex distributions of the trial participants are different, and the trials are conducted in different types of health care organizations, both trials were conducted in the United States in populations with diabetes, and the trials were carried out within a few years of each other. Both trials also compare the results of randomization to stepped depression care programs or to usual care, and the details of the depression care programs are very similar (the protocol for the intervention offered in PATHWAYS was modeled on the program developed for IMPACT). There are two

outcomes that are reported in both the IMPACT and PATHWAYS trials: total outpatient costs at 24 months, and total inpatient and outpatient costs at 24 months. Figure 2 is a forest plot showing the pooled mean difference in total outpatient costs at 24 months between the collaborative care and usual care treatment groups. There is a small excess in outpatient costs for the intervention group in the IMPACT trial, and a larger cost savings for the intervention group in the PATHWAYS trial. Neither of the mean cost differences are significant, and the pooled estimate is also not statistically significant ( $p=0.42$ ). Figure 3 is a forest plot showing the mean difference in total inpatient and outpatient costs at 24 months between the collaborative care and usual care groups. Both trials show a small net cost saving for the intervention group, but the confidence intervals are extremely wide. The pooled estimate also has a wide confidence interval, and the estimate is not statistically significant ( $p=0.58$ ).

## **Discussion**

The available evidence from randomized controlled trials of depression treatment conducted in populations with coronary disease or diabetes does not indicate that depression treatment is associated with significantly decreased health service utilization or costs, although the possibility of reductions in utilization or costs cannot be ruled out. The primary difficulty in answering questions about health service utilization and costs in populations with chronic disease or disability is the lack of data, and the consequent lack of power to address these issues. After an exhaustive review of the literature, we were able to identify only three trials of depression treatment in target populations with either health service utilization or health service cost outcomes. Most trials of depression treatment in persons with chronic physical disease or disability did not collect or did not

report on health service utilization or cost data (see list of trials in Table 1). A complete understanding of the cost consequences of depression treatment in this population relies upon the examination of health service outcome data in these trials, if available, and certainly in future trials.

We had originally hoped to conduct subgroup analyses of the effects of depression treatment in different chronic disease populations, but we were limited to two trials in diabetes patients and a single trial in patients with heart disease. The trials included in this study cannot necessarily be generalized to populations with other chronic diseases, or to populations with a high burden of various physical disorders. Economic evidence from randomized trials conducted in populations with a high burden of chronic disease, such as the elderly (eg, all participants in the IMPACT trial<sup>49</sup>) have found small nonsignificant cost increases after depression treatment. However, it is possible that, given statistical power from additional trials, significant cost savings may yet be observed in persons with diabetes or other specific diseases.

The evidence we found on interventions is limited to one trial testing the effects of a specific antidepressant (sertraline) compared to placebo, and two trials testing the effectiveness of programs aimed at improving selection and follow-up of a variety of depression treatments, including a range of antidepressants and psychotherapy. We did not find any trial evidence on the cost effects of other individual depression treatments, such as psychotherapy or self-help interventions. It is possible that there are low-cost interventions, such as exercise, that if proven effective in randomized trials would be associated with net cost savings, even during short-term follow-up, because the

intervention itself is inexpensive. However, we did not find any randomized trials of low-cost depression interventions in persons with chronic physical disease or disability.

The IMPACT and PATHWAYS trials provide new data about the long-term effects of depression treatment upon costs in populations with diabetes. Within both trials, cost savings were concentrated in non-mental health services provided during the second year of follow-up. A recent systematic review of the effects of collaborative care interventions for depression found that clinical benefits of collaborative care interventions could be observed for up to 5 years of follow-up<sup>61</sup>. This suggests that if a depression intervention has prolonged benefit for participants with chronic disease or disability, cost savings might also be seen during the third, fourth or fifth year of follow-up.

The trials included in this review also suggest that reductions in non-mental health utilization or costs after depression treatment are not necessarily dependent upon changes in medical status. The SADHART trial did not find significant differences between sertraline and placebo groups in medical outcomes, including recurrent MI and worsening of angina, or in clinical cardiac variables such as left ventricular ejection fraction, blood pressure, or electrocardiographic measures<sup>62</sup>. The IMPACT and PATHWAYS trials did not find significant effects on mean hemoglobin A<sub>1C</sub> levels, possibly because glycemic control was good at baseline, and among the self-care variables measured in the IMPACT trial, only weekly exercise days were significantly improved in the intervention group<sup>51,52,63</sup>. Reduced non-mental health service utilization may be associated with improvements in medical symptoms and on better self-management of the chronic health condition, but the included trials do not provide information on these factors.

One limitation of this review is that we were unable to assess the possibility of publication bias, since we found too few trials for funnel plots to be useful. If trials with findings of increases in health utilization and costs are less likely to be published, the results of our review would be biased in favor of cost savings. Because it was outside the scope of this review, we did not contact the investigators of trials included in Table 1. Such contact might have provided an indication of whether unpublished data on health service utilization and costs was collected, and if so, whether this data was positive or negative. A second limitation of this review is that cost data is limited to the United States context. Even the multinational SADHART trial estimates costs using the United States Medicare schedule. Evidence about utilization patterns and costs for populations, interventions, and health care systems outside the United States are lacking, and thus the results of this review are not generalizable beyond the United States. However, it could be argued that the range of practice environments in the included trials makes the consistent direction of their findings on cost and utilization data generalizable to multiple types of health care organizations within the United States.

Given the dearth of randomized evidence on the effects of depression treatment upon health service utilization or cost outcomes in persons with chronic physical disease or disability, it may be necessary to consider evidence from non-randomized sources on changes in utilization or costs after depression treatment. A recent observational study of participants in randomized trials of depression treatment, comparing participants with remitted depression to participants with persistent depression, found that remission was associated with significantly lower subsequent utilization and costs for both mental health and general medical services<sup>37</sup>. After adjustment for baseline differences, costs in the

group with persistent depression were approximately 1.5 times the costs in the group with remitted depression, which is similar to the differences between depressed and non-depressed cohorts in previous observational studies of depression and primary care costs<sup>42,64</sup>. Since not even the most effective treatment can produce remission in every treated patient, one would not expect to see results of similar magnitude from any series of randomized trials. However, this observational evidence about the consequences of depression remission does suggest that randomized trials of sufficient size, with adequate follow-up and testing effective treatments, may eventually find some cost savings from treatment of depression in primary care.

In the meantime, observational studies using administrative data to describe the consequences of depression treatment could be used to infer the presence or absence of cost savings after depression treatment in persons with chronic medical conditions. In recent years there has been extensive work done on defining adequate versus inadequate depression treatment from information available in administrative databases<sup>65</sup>, and administrative datasets have been used to consider whether there are differences in health care costs or utilization outcomes for patients with and without appropriate depression treatment. Charbonneau et al. used Veterans Affairs medical system data to assess the effects of adequate antidepressant dosage and duration upon odds of hospitalization, and found that adequate duration of antidepressant use was associated with lower odds of hospitalization for any cause during the subsequent year (OR=0.90, 95% CI 0.81, 1.00)<sup>66</sup>. Robinson et al. and Eaddy et al. used large databases of managed care claims to test whether better depression treatment was associated with reductions in medical costs, and found that patients who were adherent to treatment guidelines during the first six months

after initiating treatment had higher health care costs than non-adherent patients<sup>67</sup>, and that patients remaining on antidepressant drug therapy for at least 90 days did not have significantly different levels of total health care costs at twelve months of follow-up than patients who received fewer days of therapy<sup>68</sup>.

Comparison of data from the trials included in this review and the observational studies described above sheds some light on what we might expect to find when adding observational evidence to our findings from randomized trials. Although the population and duration of follow-up in the study conducted by Charbonneau et al. are not identical to those in the SADHART trial, it is interesting that the lower odds of hospitalization among those with active or adequate depression treatment are similar in the two analyses (0.90 for the Charbonneau study and 0.80 in the SADHART trial), and leads us to hypothesize that additional randomized or observational studies would have comparable findings. Similarly, the analyses showing that persons adhering to depression treatment guidelines have higher costs in the six months after initiation of treatment, and no difference in costs at twelve months are not surprising in light of the findings from IMPACT and PATHWAYS that costs are increased in the active treatment group during the first year of follow-up, and reduced costs are seen only during the second year. This suggests that future observational studies should follow participants for periods of two years or longer if they are to detect cost savings.

Recent studies have used administrative data from the Veterans Affairs medical system to examine the adequacy of antidepressant therapy duration for persons with chronic obstructive pulmonary disease<sup>69</sup> or diabetes<sup>70</sup>. These are first steps, however we are not aware of any studies using such administrative datasets to examine the cost or

utilization consequences of adequate depression treatment in persons with chronic physical diseases and depression. We are also not aware of observational studies comparing persons receiving different models of depression treatment (eg, collaborative care management versus usual care), and without observational evidence about the outcomes of specific treatment models, we must continue to rely upon randomized trial evidence about the effects of those treatments.

Observational studies suffer from unavoidable biases, since non-randomized comparison groups differ in multiple ways, and it is never possible to know whether confounding has been adequately controlled. Furthermore, administrative databases do not contain the level of clinical detail that would inform an understanding of the relationship between depression outcomes and cost or utilization outcomes. However, while we await the conduct of additional randomized trials in populations with chronic physical disease and depression, the most practical way to approach the question of depression treatment and changes in medical cost and utilization may be to concentrate on utilizing currently available observational evidence about these outcomes.

## **Conclusions**

While we did not find statistically significant reductions in health service costs, the studies in this review indicate that depression treatment in populations with diabetes or coronary disease and depression does not, over time, increase direct health care costs. Given that costs are not increased and that there are consistent (though non-significant) findings of cost decreases over the long term, it is possible that future analyses with increased power from additional studies might yield significant decreases in health care costs. Unfortunately, research evidence about the utilization and cost effects of

depression treatment carried out in chronic disease populations is very limited.

Randomized trials of depression treatment in chronic disease populations that recruit large sample sizes, test effective depression treatments, enroll populations with poor baseline medical and depression statuses, and observe changes in costs over longer follow-up periods may show reduced health service utilization and lower health service costs in groups randomized to active interventions. We suggest that persons conducting randomized trials of depression treatment in persons with chronic disease or disability consider incorporating information on utilization or net costs in the design and conduct of the trial<sup>71</sup>, and publish this information along with efficacy, safety, and cost-effectiveness outcomes in order to provide decision makers with information about the cost consequences of depression treatment in this population. In the meantime, available observational evidence about depression treatment and cost or utilization outcomes should continue to be pursued.

## Characteristics of Excluded Studies

Table 1: Excluded Studies of Depression Treatment in Participants with Physical Disabilities or Chronic Diseases

| Study                             | Description                                                                                                                                                                                                                                                                                                                                                          | Reason(s) for Exclusion                                                                                                                                                              |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DELTA <sup>72,73</sup>            | 361 persons aged 60 years or more with either Type II diabetes or chronic obstructive pulmonary disease and either minor depression or mild to moderate major depression will be randomized to minimal psychological intervention or usual care for up to three months. Follow-up will extend to nine months.                                                        | Cost-effectiveness will be measured, but the study is ongoing and cost outcomes have not yet been presented.                                                                         |
| Dwight-Johnson 2005 <sup>74</sup> | 55 low-income Latina participants with breast or cervical cancer and depression as measured by the Personal Health Questionnaire (PHQ) were randomized to collaborative care intervention or usual care and followed for six months.                                                                                                                                 | Although the number of contacts received as part of the intervention was collected, no health service or cost outcome data were presented.                                           |
| ENRICH <sup>75-80</sup>           | 2481 patients who were within 4 weeks of an index myocardial infarction (MI) and were either depressed or socially isolated were randomized to a 6-month cognitive-behavioral therapy intervention or to usual care. A total of 1834 met modified DSM-IV depression criteria. Participants were followed at 6 months and then yearly.                                | Secondary outcomes were to include cardiovascular-related hospitalizations but no data on hospitalizations or costs could be found for the subgroup of participants with depression. |
| Evans 1995 <sup>81</sup>          | 72 stage II cancer patients with Center for Epidemiological Studies Depression Scale (CES-D) scores of 16 or more were randomized to cognitive-behavioral treatment, social support groups, or usual care and followed to six months.                                                                                                                                | No health service use or cost data were presented.                                                                                                                                   |
| IDAAC <sup>82-86</sup>            | 674 patients hospitalized for cardiac conditions and identified as depressed on the basis of a score of 16 or more on the CES-D or a score of 8 or more on the Hospital Anxiety and Depression Scale (HADS) were randomized by general practitioner into usual care or multidisciplinary psychiatric intervention and followed at 3, 6 and 12 months after baseline. | Secondary outcomes to be measured included service utilization but no health service use or cost data could be found                                                                 |
| IMPACT <sup>87</sup>              | A subgroup analysis of the IMPACT trial, this report focused on 1,001 depressed older adults (aged 60 yrs and older) with coexisting arthritis. It is possible that some of these participants with arthritis would be the same people as the diabetic participants analyzed in the Katon report included in this review.                                            | No health service use or cost data were presented.                                                                                                                                   |

## Characteristics of Included Studies

Table 2: Included trials of depression treatment in participants with disabilities or chronic diseases

| Study                  | Participants                                                                                                                                                                                                                                                                                                                             | Setting                                                                                                                   | Intervention and comparison conditions, length of follow-up                                                                                                                                         | Clinical outcomes                                                                                                                                                                                                                                                                                                                    |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IMPACT <sup>90</sup>   | <p>A diabetes subgroup of 418/1,801 outpatients enrolled in the IMPACT trial. Elderly (mean age 70 years), 53% female, 64% white.</p> <p>Depression criteria: DSM-IV major depression (12.2%), dysthymia (48.6%), or both (59.1%).</p>                                                                                                   | Primary care clinics in a variety of health care organizations in five US states. Trial recruitment in 1999-2001.         | <p>Intervention: 3-6 month stepped collaborative care program followed by 6-12 month continuation phase</p> <p>Comparison: Usual care</p> <p>Followup: 12, 18 and 24 months after randomization</p> | Participants randomized to collaborative care had significantly more depression-free days, based upon Hopkins Symptom Checklist (HSCL) depression scores, at 24-month follow-up.                                                                                                                                                     |
| PATHWAYS <sup>91</sup> | <p>326 adult outpatients with diabetes. Middle aged (mean age 58 years), 65% male, 75% white.</p> <p>Depression criteria: Hopkins Symptom Checklist (HSCL) score indicating moderate or severe depressive symptoms. 65.6% also met DSM-IV criteria for major depression but 13% met neither dysthymia nor major depression criteria.</p> | Primary care clinics of a single mixed-model prepaid health plan in Washington and Idaho, Trial recruitment in 2001-2002. | <p>Intervention: 12-month systematic depression treatment program</p> <p>Comparison: Usual care</p> <p>Followup: 6, 12 and 24 months after randomization</p>                                        | Participants randomized to collaborative care had significantly lower mean Hopkins Symptom Checklist (HSCL) depression scores and experienced significantly more depression-free days (calculated from HSCL scores) at 12- and 24-month follow-up.                                                                                   |
| SADHART <sup>92</sup>  | <p>369 patients recruited after having had an acute myocardial infarction or a hospitalization for unstable angina. Middle aged (mean age 57 years), 66% male (66%), 76% white.</p> <p>Depression criteria: DSM-IV major depressive disorder.</p>                                                                                        | 40 clinics in the United States, Europe, Canada and Australia. Trial conducted between 1997 and 2001.                     | <p>Intervention: 24 weeks of sertraline (n=186)</p> <p>Comparison: Placebo (n=183)</p> <p>Followup: 30 days after the end of treatment.</p>                                                         | Hamilton Depression (HAM-D) scale change scores obtained at week 16 of the trial were not significantly superior in the sertraline group but the sertraline group had significantly higher Clinical Global Impression Improvement (CGI-I) scale scores and a significantly higher CGI-I based responder rate at the end of follow-up |

Table 3. Risk of bias in study design and conduct across domains\*

|          | <b>Adequate<br/>sequence<br/>generation</b> | <b>Allocation<br/>concealment</b> | <b>Blinding<br/>(utilization<br/>outcomes)</b> | <b>Blinding<br/>(cost<br/>outcomes)</b> | <b>Incomplete<br/>outcome<br/>data<br/>addressed</b> | <b>Free of<br/>selective<br/>reporting</b> | <b>Free of<br/>other<br/>bias</b> |
|----------|---------------------------------------------|-----------------------------------|------------------------------------------------|-----------------------------------------|------------------------------------------------------|--------------------------------------------|-----------------------------------|
| IMPACT   | Yes                                         | Yes                               | N/A                                            | Yes                                     | Yes                                                  | Yes                                        | Yes                               |
| PATHWAYS | Yes                                         | Unclear                           | N/A                                            | Yes                                     | Yes                                                  | Yes                                        | Yes                               |
| SADHART  | Unclear                                     | Unclear                           | Yes                                            | Yes                                     | Unclear                                              | Yes                                        | Yes                               |

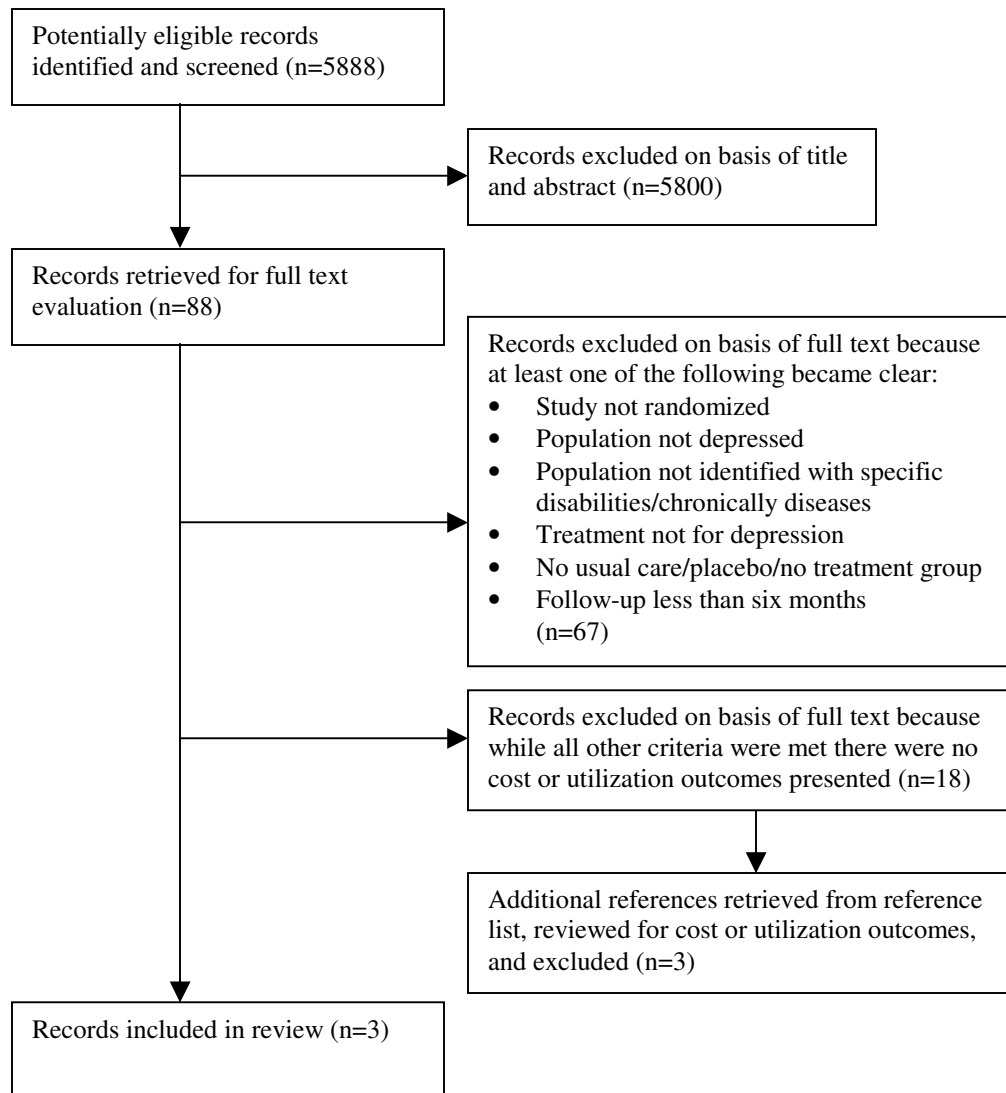
\* Yes indicates that the study design or conduct was adequate, No indicates that the study design or conduct was not adequate, Unclear indicates that it was not clear from the study report whether or not the study design or conduct was adequate, and N/A indicates that the design or conduct element was not applicable.

Table 4: Health Service Utilization and Costs Outcomes from Included Studies

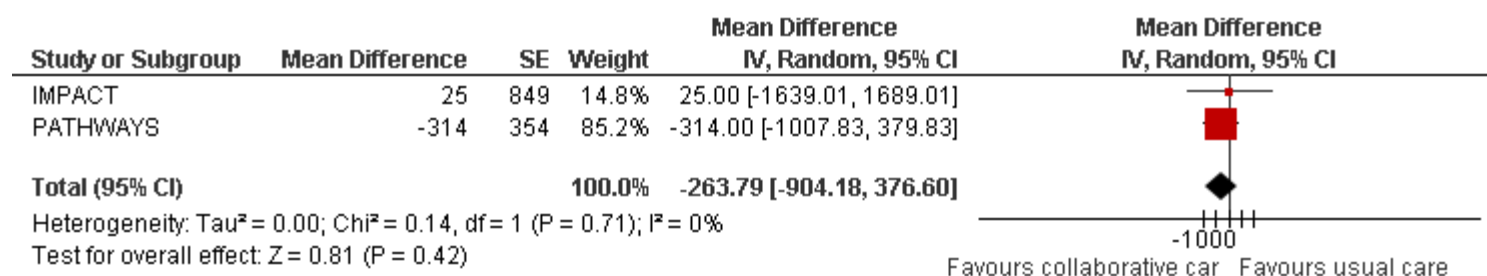
| Study                  | Health service utilization                                                                                                                                                                                                                                                                                                                                                                                                    | Health service costs*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IMPACT <sup>90</sup>   | None reported                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>Mean total outpatient costs at 24 months (primary cost outcome):<br/>Mean difference: 25 (95% CI -1,638 to 1,689) higher in intervention group</p> <p>Mean total outpatient costs at 12 months:<br/>Mean difference: 665 (95% CI -340 to 1,670) higher in intervention group</p> <p>Mean total outpatient costs for second 12 months:<br/>Mean difference: 639 (95% CI -1,714 to 435) lower in intervention group</p> <p>Mean total inpatient and outpatient costs at 24 months:<br/>Mean difference: 896 (95% CI -4,549 to 2,755) lower in intervention group</p> <p>Mean total inpatient and outpatient costs for first 12 months:<br/>Costs were 515 (95% CI -2,136 to 3,165) higher in intervention group</p> <p>Mean total inpatient and outpatient costs for second 12 months:<br/>Costs were 1,411 (95% CI -3,821 to 998) lower in intervention group</p> |
| PATHWAYS <sup>91</sup> | None reported                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>Total outpatient costs at 24 months (primary cost outcome):<br/>Mean difference: 856 (95% CI -1,656 to -55) lower in intervention group<br/>Adjusted Mean difference: 314 (95% CI -1,007 to 379) lower in intervention group</p> <p>Mean total outpatient costs for first 12 months:<br/>Mean difference: 26 (95% CI -1572 to 1624) higher in intervention group</p> <p>Mean outpatient costs for second 12 months:<br/>Mean difference: 1,404 (95% CI -3361 to 553) lower in intervention group</p> <p>Mean total inpatient and outpatient costs at 24 months:<br/>Mean difference: 1,110 (95% CI -8658 to 6438) lower in intervention group</p>                                                                                                                                                                                                                |
| SADHART <sup>92</sup>  | <p>Any ER visit at 7 mos:<br/>Sertraline: 18/186 (9.7%) Placebo: 25/183 (13.7%)<br/>OR for any ER visit=0.68 (95% CI 0.36, 1.28)<br/>Number of ER visits: Sertraline: 26, Placebo: 40 (p=0.080)</p> <p>Any hospitalization at 7 mos:<br/>Sertraline: 44/186 (23.7%) Placebo: 51/183 (27.9%)<br/>OR for any hospitalization=0.80 (95% CI 0.50, 1.28)<br/>Number of hospitalizations: Sertraline: 55, Placebo: 76 (p=0.054)</p> | <p>Estimated mean direct medical costs at 7 months:<br/>Sertraline: 3,093 (standard deviation and confidence interval not given)<br/>Placebo: 3,326 (sd=7,195; 95% CI 2,277 to 4,375)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

\*All costs are in U.S. dollars, not adjusted for price year, and not adjusted for covariates unless otherwise noted.

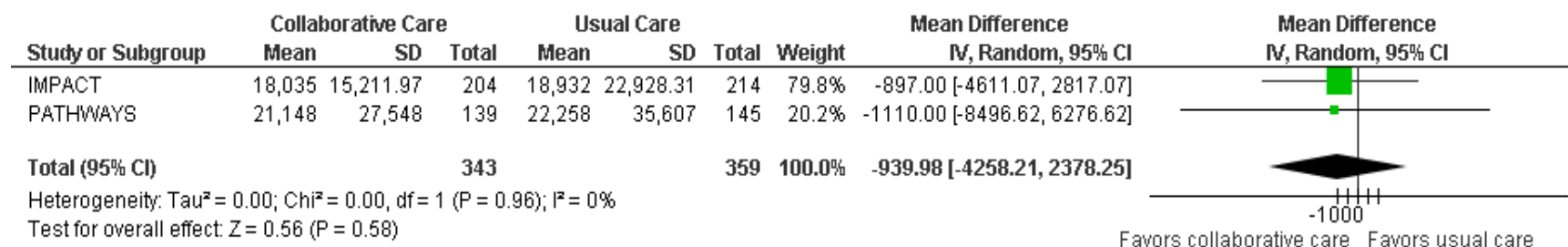
Figure 1. QUOROM<sup>93</sup> flow diagram of records screened for the review



**Figure 2. Forest plot comparing collaborative care to usual care: outpatient costs at 24 months:**



**Figure 3. Forest plot comparing collaborative care to usual care: total inpatient and outpatient costs at 24 months:**



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## SADHART

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