

# Potentially Preventable Emergency Department Use Among Ramsey County Residents, 2010-2014

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**Emergency Department Use  
Among Ramsey County Residents, 2010-2014**

Planning and Performance Improvement  
Saint Paul – Ramsey County Public Health  
90 Plato Blvd W  
St. Paul, MN 55107  
Phone: 651-266-2400

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## Preface

This study was done to develop a more complete picture of how emergency departments (EDs) are used by Ramsey County residents. Using quantitative data, it explores potentially preventable ED visits over a five-year period.

The study was developed by the Ramsey County Access to Health Services Action Team with research conducted by Saint Paul – Ramsey County Public Health. A copy of the study can be downloaded from [www.ramseycounty.us/EDstudy](http://www.ramseycounty.us/EDstudy), or can be obtained by contacting Sue Mitchell at [sue.mitchell@co.ramsey.mn.us](mailto:sue.mitchell@co.ramsey.mn.us)

## Acknowledgements

This study could not have been completed without the generous analytic contributions of David Levitt, M.D., Ph.D., a member of the Ramsey County Access to Health Services Action Team. Michael Oakes, Ph.D. from the University of Minnesota, School of Public Health provided early guidance; patiently answered Stata software questions and continues to provide us research articles from the literature.

The Ramsey County Access to Health Services Action Team, implementing Goal 3 of the Ramsey County Community Health Improvement Plan\*, has been involved during all stages of the study and continues to work toward improving access to health care for all residents.

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\*[https://www.ramseycounty.us/sites/default/files/Departments/Public%20Health/CHIP\\_report\\_rev\\_june2016.pdf](https://www.ramseycounty.us/sites/default/files/Departments/Public%20Health/CHIP_report_rev_june2016.pdf)

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# Summary

Assuring access to health care is one of the essential services of public health.<sup>[1]</sup> Further, access means these health services should be provided at the right time and in the right place. Research into emergency department (ED) utilization is one way public health departments can assure access to health care services. Assuring access to care is also one of five goals in the Ramsey County Community Health Improvement Plan. This study was undertaken as part of the implementation of this plan.<sup>[2]</sup>

The study of ED utilization in a population provides a window into the community's local primary care system. Analysis of patterns of use among population subgroups and geographic areas can be useful in identifying areas of concern to focus further inquiry or develop intervention strategies.

Administrative claims data from the Minnesota Hospital Association were used to review patterns of utilization among Ramsey County residents during 2010-2014. The data are based on visits rather than on individual patients thus it is beyond the scope to determine repeat users of an ED. This report, part 1 of the study, presents a description of ED visits and the probability of those visits being potentially preventable with effective and timely primary care services.

This study does not report on the factors that went into an individual's decision to visit an ED. Part 2 of our study conducted in partnership with others in the health sector, will ask patients directly about the factors involved in deciding to visit an ED. Only after completion of part 2 can effective interventions be designed so that all Ramsey County residents can receive health care services equitably, at the right time and place.

## Major findings:

- During 2010-2014, Ramsey County residents made almost 1 million visits to an ED.
- The most common time for visits were Sundays and Mondays between the hours of 6 p.m. and 8 p.m.
- All ED visits were classified using the methodology developed by Billings et. al. at NYU which excludes some visits. The NYU algorithm was then run on the remainder of visits (n=464,501) to determine potentially preventable visits.
- After classifying ED visits using the algorithm, 77.2 percent of visits were found to be potentially preventable if timely and effective ambulatory care had been received during the episode of illness.
- The highest number of potentially preventable ED visits were made by residents who live in ZIP code 55101 in St. Paul (231 visits/100 population), followed by residents in ZIP codes 55103 and 55130.
- Even though young adults 25-34 years had the highest volume of visits (66,206 visits), when adjusted for population size, Ramsey County children under 5 had the highest rate of potentially preventable ED visits.

# Introduction

Emergency departments are the only place in the country where no one can be turned away because in 1986, Congress enacted the Emergency Medical Treatment & Labor Act (EMTALA) to ensure public access to emergency services regardless of ability to pay.\* EDs play a critical role in the acute care system providing a safety net for low income and other disadvantaged populations. Many patients with acute care needs rely on safety net providers. EDs and community clinics have traditionally been the primary providers of care for the under and uninsured. EDs also provide a significant amount of acute care to vulnerable populations such as the people experiencing homelessness, people living with HIV/AIDS, veterans, people with mental health and substance abuse disorders, and the prison population. In 2010 before implementation of the Affordable Care Act, four percent of doctors who staff U.S. emergency departments managed 28 percent of all acute care visits in the country, with half of all the acute care provided to Medicaid and Children’s Health Insurance Program beneficiaries. Two-thirds of the acute care provided to the uninsured takes place in an ED.<sup>[3]</sup> Eleven percent of all outpatient visits in the U.S. were provided in an ED with about half of those visits being admitted into the hospital.<sup>[3]</sup> Contrary to conventional understanding, however, ED visits accounted for only 2-4 percent of total annual health care expenditures.<sup>[4]</sup>

It is common knowledge that not all ED visits are for urgent conditions especially among patients insured by a public program who disproportionately use EDs. Medicaid patients use the emergency room at twice the rate of those with private insurance, according to the Centers for Medicare & Medicaid Services.<sup>[5]</sup> Although some states use higher copayments to dissuade publicly insured patients from unnecessary visits to EDs,<sup>[6]</sup> there is strong backlash to these policies among emergency physicians and others in health policy and public health since increased copays may lead people to think twice about seeking emergency care when they really need it. Several states have developed lists of non-emergency diagnoses and, in some cases, are limiting payments to Medicaid providers. Thus, payers now more than ever are showing increasing interest in understanding the extent to which non-emergency conditions drive ED utilization.<sup>[6]</sup>

Basic issues of access are key determinants of emergency department use. Since the 1970s, researchers have recognized the rapid rise in ED utilization as well the continuous theme of the relationship between ED utilization and having a source of primary care.<sup>[7]</sup> Rates of ED use for treatment of conditions that are potentially preventable have been widely used as an indicator of limited access to primary care, with variations in these rates across groups reflecting disparities in access.<sup>[8] [9] [10] [11] [12] [13]</sup> As such, the rate of potentially preventable ED visits provides insight into the quality and accessibility of the health care system in communities.

## Aims of this Study

This study, the first local county population-based potentially preventable ED study in Minnesota, will serve as the baseline analysis of ED utilization among Ramsey County residents leading to in-depth conversations among a variety of stakeholders who are concerned about health care quality and access. Differences in potentially preventable ED use by ZIP code and/or socio-economic factors can inform us about barriers to primary care that may exist for certain populations of the county and provide insight into the relative depth and success of interventions.

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\*<https://www.cms.gov/Regulations-and-Guidance/Legislation/EMTALA/>

This analysis was designed to answer the following questions:

- What is the degree of ED use among Ramsey County residents?
- To what extent are residents using hospital EDs for potentially preventable visits?
- Have the number of potentially preventable ED visits changed over time?
- Do potentially preventable ED visits differ by patient demographics including age, residence, and payer type?

## Classifying ED Visits

Even though there is no universal agreement on how to classify ED visits for research and public policy discussions, the diagnostically based and empirically verified New York University emergency department algorithm (NYU algorithm) designed by Billings et. al. is by far the most commonly used program.<sup>[14]</sup> With support from the Commonwealth Fund, the Robert Wood Johnson Foundation, and the United Hospital Fund of New York, the NYU Center for Health and Public Service Research developed the algorithm to help classify ED utilization. In addition to the information analyzed on the severity of ED visits, the NYU Algorithm has the added advantage of empirically linking the diagnoses to the role of the primary care physician and the capacity of the community health system in which the patient lives.<sup>[15]</sup>

Based on the information abstracted from patient medical records, the NYU researchers used their algorithm to place ED visits into the following four categories after excluding visits for injury, mental health, alcohol/drug and unclassified:

- 1) Nonemergent – The patient’s initial complaint, presenting symptoms, vital signs, medical history, and age indicated that immediate medical care was not required within 12 hours.
- 2) Emergent/Primary Care Treatable – Based on information in the record, treatment was required within 12 hours, but care could have been provided effectively and safely in a primary care setting. The complaint did not require continuous observation, and no procedures were performed or resources used that cannot be provided in a primary care setting (e.g., CT scan or certain lab tests).
- 3) Emergent, ED Care Needed, Preventable/ Avoidable – Emergency department care was required based on the complaint or procedures performed/ resources used, but the emergent nature of the condition was potentially preventable/avoidable if timely and effective ambulatory care had been received during the episode of illness (e.g., flare-ups of asthma, diabetes, congestive heart failure, etc.).
- 4) Emergent, ED Care Needed, Not Preventable/Avoidable – Emergency department care was required and ambulatory care treatment could not have prevented the condition (e.g., trauma, appendicitis, myocardial infarction, etc.).

The algorithm assigns probabilities to each of the 4 categories. The probabilities sum to 1.0 for any given diagnosis. Some examples of diagnoses and probabilities assigned by the NYU algorithm are shown in Table 1. The assignments in the algorithm have a straightforward interpretation.

- Admission 1 for subarachnoid hemorrhage is deemed emergent and not preventable or avoidable or primary care treatable. Hence, it receives a probability of 1.00 for category 4 and probability 0.00 for all other categories.
- Admission 2 for acute edema of lung, unspecified required ED care but could have been prevented by better ambulatory care. Hence, it is assigned a probability of 1.00 for “emergent, but preventable or avoidable” (category 3), above) and 0.00 for the other categories.
- Admission 3 for abdominal pain, epigastric has mixed probabilities across the categories. Abdominal pain, epigastric is assigned a 0.67 probability of being emergent-primary care treatable (category 2). There is some chance the ED care was needed and not preventable (category 4).



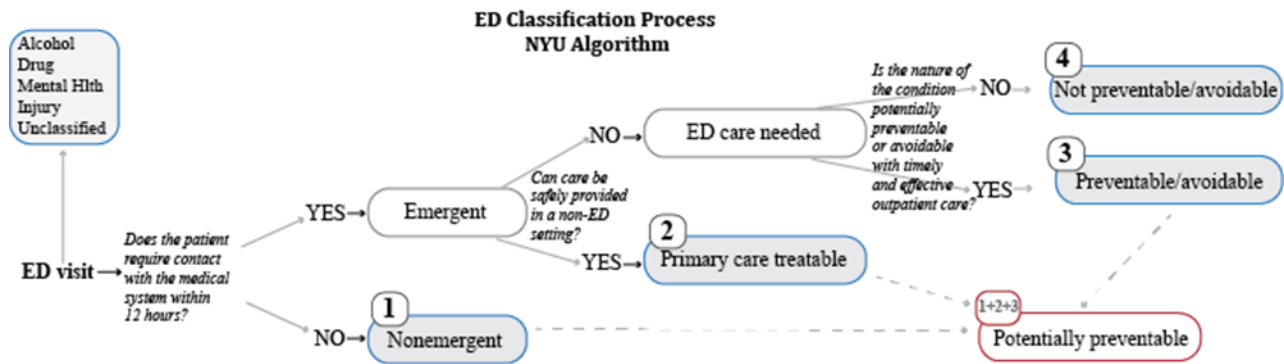
- Admission 5 for chronic rhinitis is deemed clearly nonemergent because this diagnosis does not require ED care.

Table 1: Examples of NYU algorithm classifications

	(1) Nonemergent	(2) Primary Care Treatable	(3) Preventable or Avoidable	(4) Not Preventable, Avoidable	Sum of Probabilities
Subarachnoid hemorrhage (diagnosis code 430)	0.00	0.00	0.00	1.00	1.00
Acute edema of lung, unspecified (diagnosis code 518.4)	0.00	0.00	1.00	0.00	1.00
Abdominal pain, epigastric (diagnosis code 789.06)	0.00	0.67	0.00	0.33	1.00
Chronic maxillary sinusitis (diagnosis code 473.0)	0.75	0.15	0.00	0.10	1.00
Chronic rhinitis (diagnosis code 472.0)	1.00	0.00	0.00	0.00	1.00

After excluding visits with alcohol/drug, mental health, injury and unclassified diagnoses, ED visits falling into the NYU categories 1 through 3 are defined as potentially preventable for this study. These include all nonurgent ED visits plus all visits that require immediate ED care but the nature of the condition could have been potentially prevented if timely and effective ambulatory care services been received earlier by the patient. Figure 1 illustrates the classification process used by the NYU algorithm.

Figure 1: NYU algorithm classification process



The classification system for ED visits developed by Billings and colleagues was used because it is available in the public domain at no cost and is still the most widely used classification system in the literature. [16]

# Methods

## Data Source

Computerized administrative data from ED payer claims for all Ramsey County residents was obtained from the Minnesota Hospital Association (MHA) for the years 2010-2014. The data describe each ED visit and list the year, day of week, beginning hour of visit, ZIP code, expected primary payer group, hospital, ICD-9 discharge diagnoses, diagnostic e-codes, patient age and gender, and whether the patient was admitted to the hospital from the ED. The MHA data set is based on visits; individual patients are not identified. The data set de-identified patient’s names and street addresses, and race/ethnicity was not included.

Income data for Ramsey County ZIP codes is from the U.S. Census American Community Survey 2010-2014-five-year estimates. The 2013 Minnesota Health Access Survey was used to determine population rates for insurance types.<sup>[17]</sup>

Data were examined for residents receiving ED care anywhere in Minnesota, North and South Dakota, and Iowa. Wisconsin does not have an agreement to share claims data with MHA thus visits by Ramsey County residents to a Wisconsin ED are excluded from this study. Visits to the Minneapolis VA Health Care System and Shriners Hospital for Children were also not included in the data set.

There were nine payer groups in the original data set:

- 1) Uninsured
- 2) Medical Assistance (Minnesota’s term for Medicaid) fee-for-service
- 3) Medicare
- 4) Commercial insurance-group or individual plans
- 5) Managed care insurance-group or individual plans (HMOs and PPOs -Blue Cross, HealthPartners, Medica, Preferred One, etc.)
- 6) Managed care Medicare supplemental insurance plans
- 7) Managed care-public insurance (pre-paid medical assistance plans-PMAPs, MinnesotaCare, capitated Medical Assistance)
- 8) Other government (Indian Health Service, Veteran CHAMPUS, etc.)
- 9) Other

For this analysis, payer groups 2, 6 and 7 were merged into a new payer group called “Public Insurance”; individual eligibility for these Minnesota-specific public insurance plans is based on federal Medicaid eligibility. Payer groups 8 and 9 were grouped together as “Other”.

### Analytical Approach

The application of the NYU algorithm to individual visit data was applied to a 100% sample of ED visits made by Ramsey County residents during 2010-2014. After excluding unclassified, injury, mental health and alcohol/drug visits, the NYU algorithm mapped the primary ICD-9 discharge diagnosis of the remaining ED visits to the probability that the ED visit could be put in one of the four classifications (Figure 1 above) using a cutoff of  $>.50$ . In case of ties within the classifications, the diagnosis was deemed to be categories 2, 3, and 4 in descending order. Next, by converting the probabilities into proportions of ED visits, the proportion of all ED visits that fell into each of the categories was calculated. The NYU algorithm classifications for each discharge diagnosis were merged with the MHA data set and all analysis was completed using Stata® 14.1 SE statistical software.

Researchers vary on whether to include visits resulting in an admission in an analysis. After the algorithm was run, the decision was made to take out the visits resulting in an admission for NYU classifications, 1 Nonemergent (n=3,786) and 2 Primary Care Treatable (n=8,570) since those classifications assert that care could have been provided in an outpatient setting within the next twelve hours. We did include both treated and released visits and visits resulting in a hospital admission that fell into the category of 3 Emergent Preventable/Avoidable (n=11,788 visits). Using this approach, our analysis indicated that 77.2 percent of visits were potentially preventable. If all admissions had remained in our analysis, our potentially preventable visits would have been 80%. If all admissions had been taken out of the analysis, the potentially preventable visits would have been 75 percent, not a large variation.

# Findings

## All ED visits by Ramsey County residents

There were 900,050 individual ED visits (claims) made by residents of Ramsey County to 239 hospitals during the period of January 1, 2010 to December 31, 2014.

Overall, 17 percent of the ED visits by Ramsey County residents resulted in being admitted to the hospital. A very high percentage (40.2%) of Medicare patients were admitted compared to about 14 percent or less for the other payer groups. This is, presumably, because visits made by patients who are covered by Medicare are older and more likely to have chronic or serious illnesses. A surprising result is the extremely low percentage (4.6%) of uninsured patients that were admitted to the hospital from the ED. The explanation for this is uncertain and deserves further study.

Additional detail on the characteristics of ED visits resulting in an admission can be found in Appendix Table A. Table B in the appendix lists the top twenty primary diagnostic groups for all ED visits, by patient age and sex for Ramsey County residents.

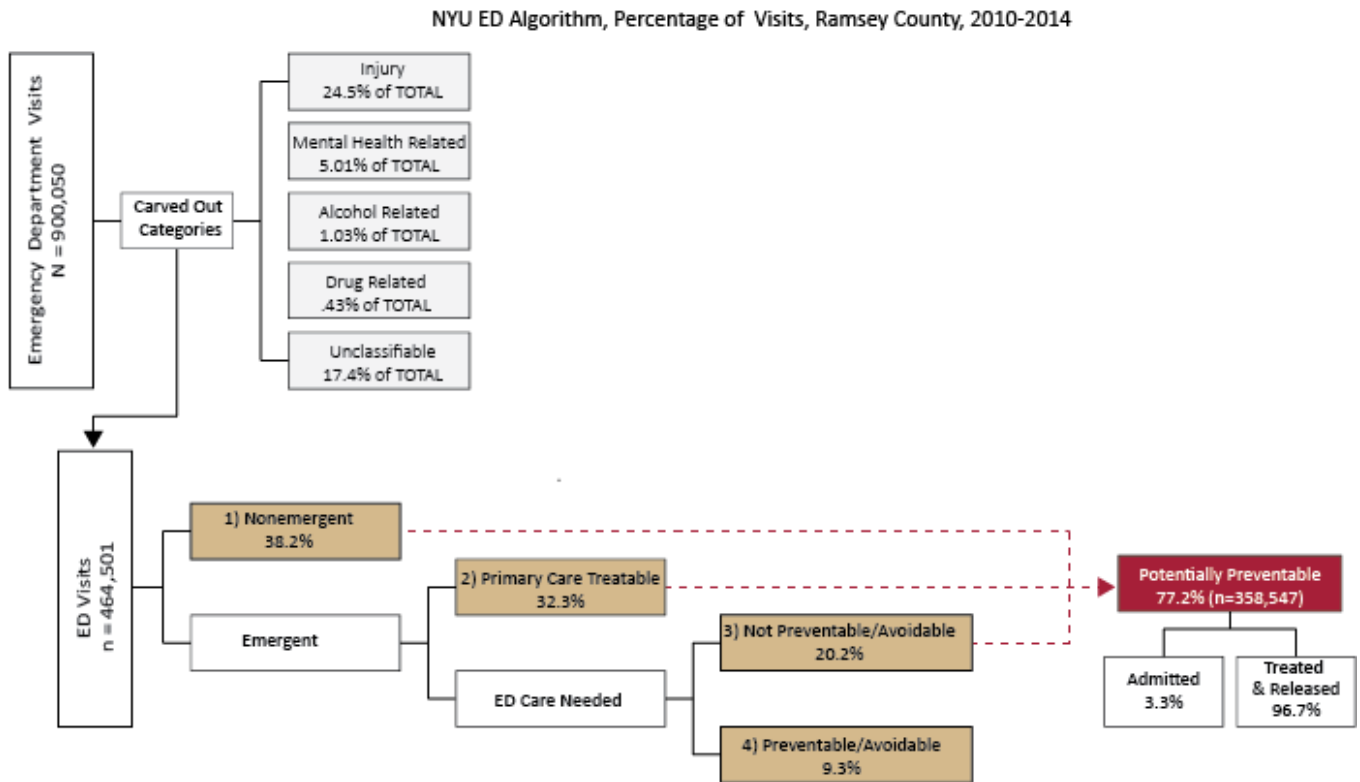
Publicly insured residents had the highest number of visits followed by visits among residents who had group or individual insurance. Table 2 lists the number and percentage of visits by primary payer group.

Table 2: Total visits by payer group

<b>Payer Groups</b>	<b>Number of Visits</b>	<b>Percent Distribution</b>
Uninsured	60,834	6.8
Public Insurance	370,382	41.2
Group/Individual Insurance	276,452	30.7
Other Payers	30,838	3.4
Medicare	161,544	17.9
Total	900,050	100.00

Figure 2 on the following page displays the breakout of all ED visits by the classifications of the NYU algorithm and those that are excluded from the analysis. The algorithm was then run on the remainder of visits (n=464,501) to determine potentially preventable visits.

Figure 2: NYU algorithm applied to Ramsey County visits



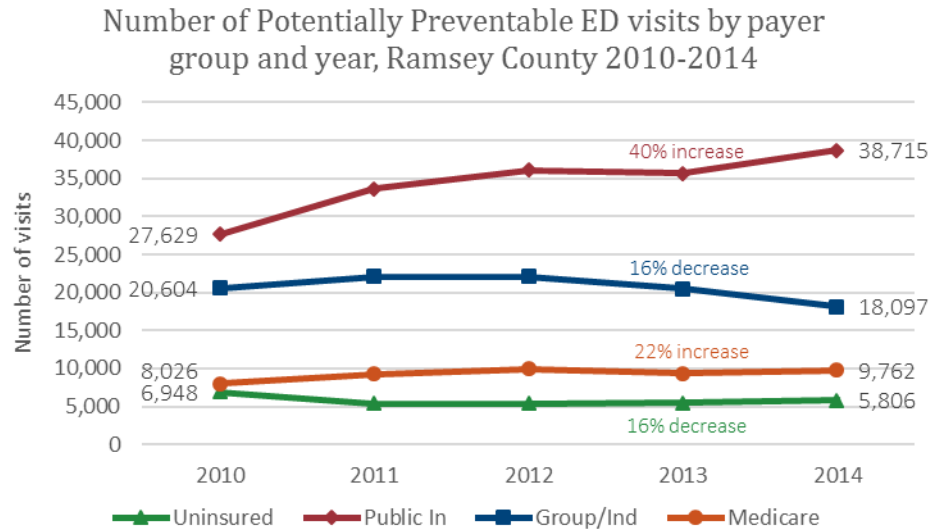
The remainder of the study findings focus only on the 464,501 ED visits which remained after the excluded NYU categories. Potentially preventable visits made up 77.2 percent of those visits.

# Potentially Preventable ED Visits

## Potentially preventable visits by payer

Figure 3 displays the number of potentially preventable visits for each payer group over the five-year period. Publicly insured visits increased by 40% while group and individually insured visits decreased by 16%. Medicare visits increased by 22% and uninsured visits decreased by 16% during 2010-2014.

Figure 3: Volume of potentially preventable visits by payer over time



Studies indicate that Medicaid patients have higher rates of ED use than the general population.<sup>[18]</sup> A closer look at publicly insured visits among Ramsey County residents reveals the rates over time (Table 3). The last column in Table 3 displays the ratio of publicly insured potentially preventable ED visits to the population (% publicly insured ED visits/ % public insurance population). ED visits billed to public insurance were on average 1.59 times the rate of the population who were insured by public insurance with a large drop in this rate occurring between 2013 and 2014. The reason for this decrease is unknown and deserves further study.

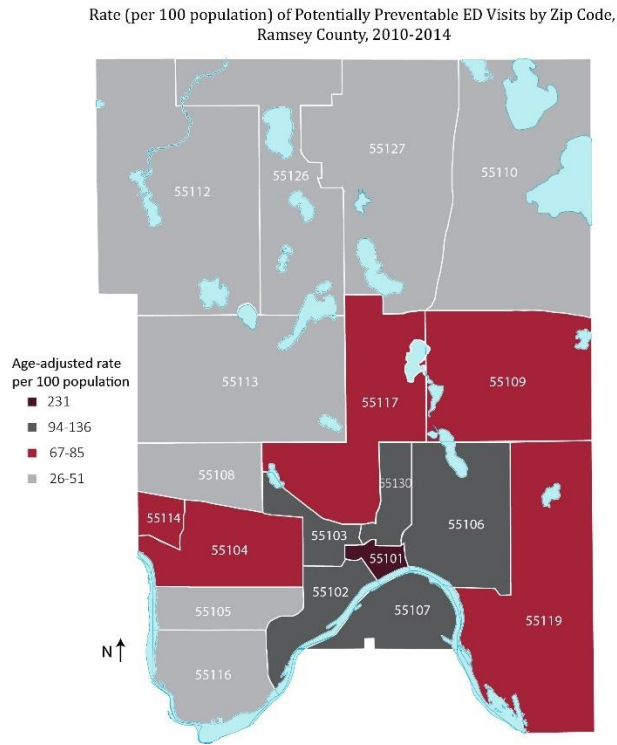
Table 3: Ratio of publicly insured potentially preventable ED visits to population

Year	Publicly insured ED visits	Residents on a public insurance program	Publicly insured ED visits/ population on public insurance program
2010	32.8%	20.8%	1.58
2011	36.2%	22.2%	1.63
2012	37.1%	22.6%	1.64
2013	38.0%	23.1%	1.64
2014	40.2%	27.4%	1.46
Average	36.9%	23.2%	1.59

**Potentially preventable visits by patient ZIP code**

After adjusting for the age of the population in each Ramsey County ZIP code, rates of potentially preventable ED visits are highest for ZIP code 55101 in St. Paul (Figure 4). There is a detailed table with each ZIP code by age group in Appendix Table C.

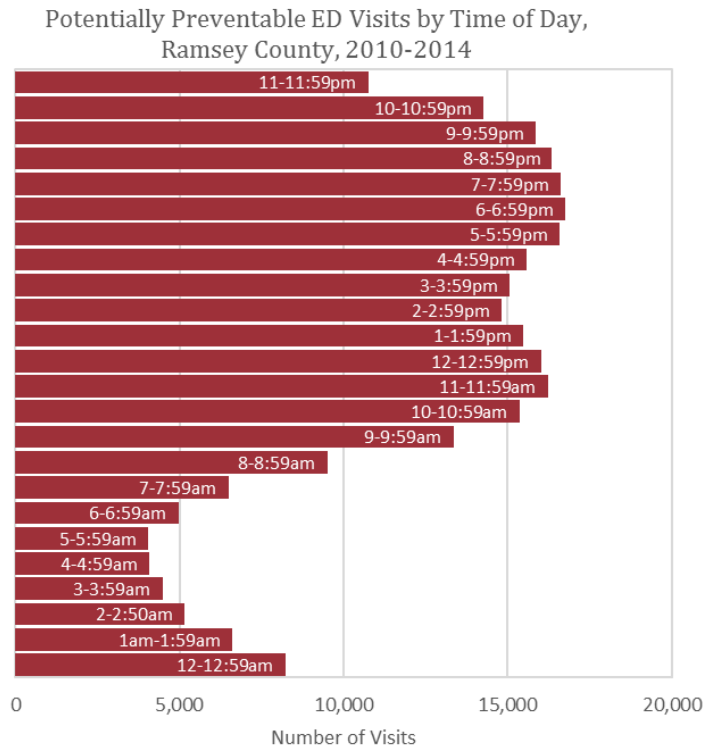
Figure 4: Rate of potentially preventable ED visit by patient ZIP code



**Potentially preventable visits by time and day**

Almost 50 percent (46.5%) of potentially preventable ED visits occurred between 8 a.m. and 5 p.m. when primary care clinics are open. (Figure 5). There were only small differences between the days of the week, but most visits occurred on Mondays.

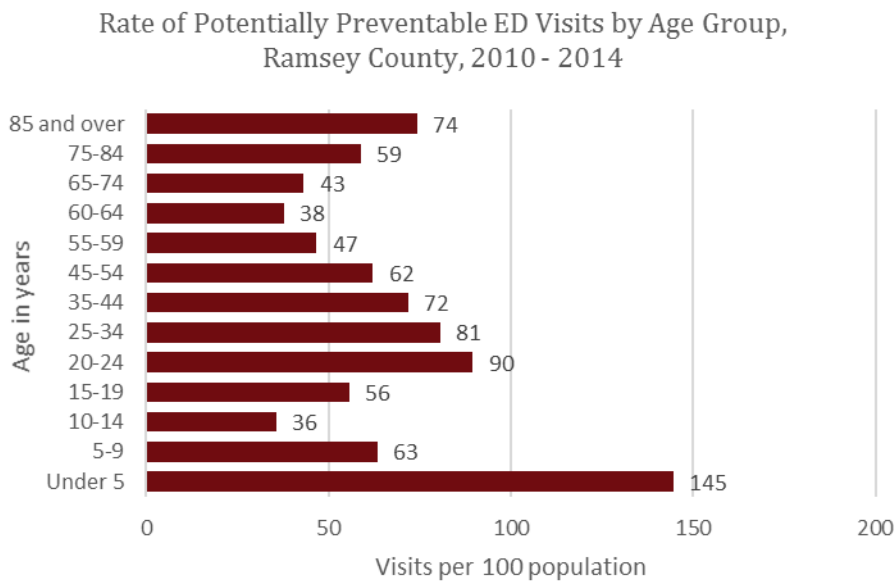
Figure 5: ED visit start times



Potentially preventable visits by age

Ramsey County residents ages 25-34 had the highest volume of potentially preventable ED visits. But when adjusted for population size, Ramsey County residents under age 5 have the highest rate of potentially preventable ED visits (Figure 6).

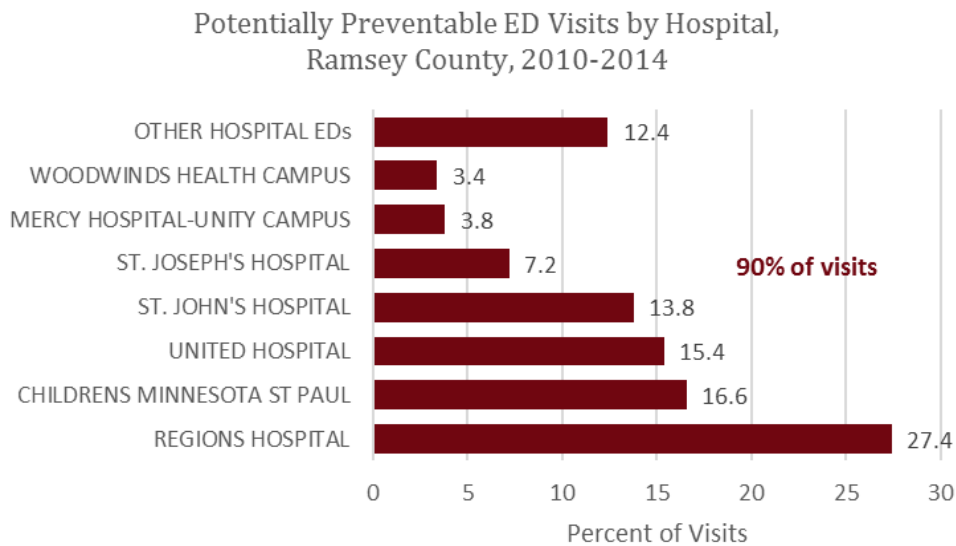
Figure 6: Rates of potentially preventable ED visits



**Potentially preventable visits by hospital**

Out of all the hospitals where Ramsey County residents visited an ED, Regions Hospital by far had the greatest number of visits by residents and the most potentially preventable visits. (Figure 7). In fact, Regions Hospital had the most ED visits by Ramsey County residents in all categories. Ninety percent of all potentially preventable ED visits were made to seven hospitals, all in the Twin Cities east metro area except for Unity Hospital in Fridley.

Figure 7: Potentially preventable ED visits by hospital



**Potentially preventable visits by diagnosis**

Table 4 displays the top 20 diagnoses for potentially preventable visits made by Ramsey County residents over the study period. Urinary tract infections, headaches and abdominal pain top the list. Appendix Table C includes this detail broken out by age group of the patients.



Table 4: Top diagnoses for potentially preventable ED visits

Top 20 Diagnoses for Potentially Preventable Visits, Ramsey County, 2010-2014

Principle Diagnosis	Number of Visits	Percent Distribution
Acute uri NOS	17,650	4.9
Headache	14,640	4.1
Abdmnal pain oth spcf st	13,231	3.7
Otitis media NOS	12,975	3.6
Abdmnal pain unspcf site	12,572	3.5
Chest pain NEC	10,766	3.0
Pneumonia, organism NOS	10,322	2.9
Asthma NOS w (ac) exac	9,658	2.7
Acute pharyngitis	8,853	2.5
Lumbago	8,848	2.5
Pain in limb	8,472	2.4
Vomiting alone	7,926	2.2
Strep sore throat	7,810	2.2
Cough	7,061	2.0
Dental disorder NOS	6,816	1.9
Nausea with vomiting	6,688	1.9
Abdmnal pain epigastric	6,370	1.8
Dizziness and giddiness	6,268	1.8
Painful respiration	6,029	1.7
Backache NOS	5,343	1.5

## Study Limitations

Since our study does not identify people it is impossible to determine repeat visits by individual patients. In addition, this study is based on the NYU algorithm, it does not analyze ED patient presenting complaints. There is evidence that this approach may not accurately determines who needs care.<sup>[18]</sup>

Some clinicians have raised issues with the clinical validity of using the NYU algorithm to classify ED visits. Researchers at the University of California, found that the algorithm could not reliably identify non-emergency visits due to the limited correspondence between the symptoms with which the patient initially presented and their final discharge diagnoses. In fact, the study found that the symptoms presented in non-emergency visits matched the symptoms presented in almost 90 percent of emergency visits.<sup>[19]</sup> Thus, an ED physician would have to triage patients arriving at the ED with these symptoms to rule out more serious conditions.

The NYU algorithm carves out visits classified as mental health, alcohol/substance and injury diagnoses, and unclassified visits before conducting any analysis. This process lowered our total visits almost in half.

Other researchers have raised concerns about the statistical reliability of the NYU ED algorithm because the outputs of the algorithm are based on chart reviews from a small geographic area that may limit broader applicability.

## Discussion

A patient who accesses care through an ED will gain few health benefits of primary care, further exacerbating health disparities as primary care encompasses preventive medical care. ED utilization for potentially preventable conditions is neither an equal substitute or an adequate replacement for primary care. While many patients can receive quality care in EDs, their care is not without extra expenses imposed on themselves, the hospitals, and other insurance buyers or its system participants. Most importantly, nonurgent and potentially preventable visits in EDs is a sign that the dimensions of access do not fit the needs of the communities or population in question.

In 2015, the Office of Clinical Practice Innovation at George Washington University developed a model for management of acute, unscheduled care in the U.S. <sup>[20]</sup> Among their recommendations are suggestions for policy level interventions:

- Ensure evidence-based prevention is implemented
- Enact and adequately fund public health laws to enhance prevention
- Align patient incentives for positive health behaviors
- Align incentives of providers to meet patient needs
- Ensure workforce meets care needs
- Enhance quality measurement
- Reward best practice

Policymakers can implement laws that impact social determinants such as poverty, violence, food access, and those that impact health such as promoting healthy behaviors. Payers and policymakers can create programs, policies or laws that provide incentives to create greater access for patients, and ensure that the workforce matches patient demands. Incentives could be provided to patients to promote healthy behaviors, such as paying for gym memberships, weight loss, or smoking cessation programs.

Policymakers and payers can create a broader set of metrics that ensure patients get the right care, efficient care, and that information flows freely across settings. Payment models could incentivize the creation of additional patient-centered programs, such as patient-centered medical and behavioral health care homes as Minnesota is doing.

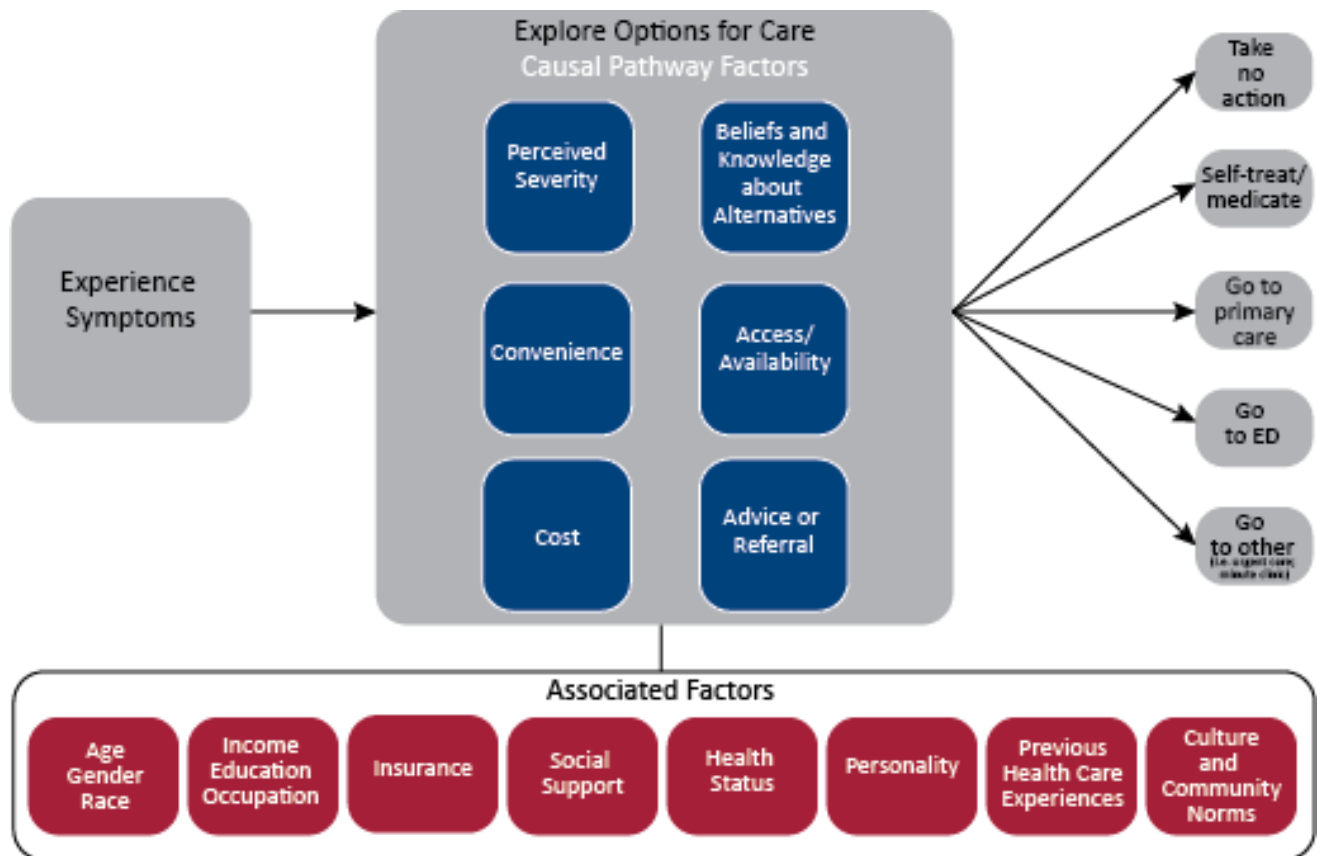
It is through analysis and the public health responsibility to social justice and equity that a solution for potentially preventable visits will be deemed not only to be necessary, but warranted by a commitment by us to just health. By understanding the current gaps in the dimensions of access, it clarifies where our health care system does not “fit” the needs of patients and how the most basic barriers to access have persisted.

# Next Steps

Thousands of Ramsey County residents used emergency departments under circumstances and with conditions that may be more appropriately managed in other care settings during 2010-2014. To successfully reduce potentially preventable ED use, we need to understand the multifaceted reasons patients visit the ED. Hearing directly from patients will help identify those reasons. To better understand causal pathways and to build a model of patient-centered care for Ramsey County residents, we must include the patient perspective. Part 2 of this study will help us learn directly from patients themselves why they chose to visit the ED.

Uscher-Pines and colleagues conducted a systematic review of the U.S. literature for studies published after 1990 that assessed factors associated with nonurgent ED use. Based on those results they developed a conceptual framework (Figure 8) to understand the factors influencing an individual’s decision to visit an ED.<sup>[21]</sup> This conceptual model will be explored in Part 2 of our study.

Figure 8 Conceptual model for part 2 of study



# References

1. The Public Health System and the 10 Essential Services. Centers for Disease Control and Prevention Web site. <https://www.cdc.gov/nphpsp/essentialservices.html>. Accessed May 11, 2016.
2. Ramsey County Community Health Improvement Plan 2014-2018. Saint Paul - Ramsey County Public Health Web site. [https://www.ramseycounty.us/sites/default/files/Departments/Public%20Health/CHIP\\_report\\_rev\\_june2016.pdf](https://www.ramseycounty.us/sites/default/files/Departments/Public%20Health/CHIP_report_rev_june2016.pdf). Accessed June, 1, 2017.
3. Pitts S, Carrier E, Rich E, Kellermann A. Where Americans get acute care: increasingly, it's not at their doctor's office. *Health Aff (Millwood)*. 2010; 29(9): 1620-1629.
4. ACEP Poll: Affordable Care Act Research Results. American College of Emergency Physicians Web site. <http://assets.fiercemarkets.net/public/healthcare/2015%2BACEP%2BACA%2BPoll%2BReport%2BFINAL.pdf>. Accessed June, 8, 2016.
5. Centers for Medicare & Medicaid Services. Reducing Nonurgent Use of Emergency Departments and Improving Appropriate Care in Appropriate Settings. U.S. Department of Health and Human Services. 2014.
6. States strive to keep Medicaid patients out of the emergency department. Stateline Web site. <http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2015/2/24/states-strive-to-keep-medicaid-patients-out-of-the-emergency-department>. Accessed July 05 2016.
7. Davidson S. Understanding the growth in emergency department utilization. *Med Care*. 1978; 16: 122-132.
8. Falik M, Needleman J, Wells B, Korb J. Ambulatory care sensitive hospitalizations and emergency visits: experiences of Medicaid patients using federally qualified health centers. *Med Care*. 2001; 39(6): 551-561.
9. Epstein A. The role of public clinics in preventable hospitalizations among vulnerable populations. *Health Serv Res*. 2001; 36(2): 405-420.
10. Hossain M, Laditka J. Using hospitalization for ambulatory care sensitive conditions to measure access to primary health care: an application of spacial structural equation modeling. *Int J Health Geogr*. 2009; 8: 51.
11. Jiang H, Wier M, Potter D, Burgess J. Potentially preventable hospitalizations among Medicare-Medicaid dual eligibles, 2008. Agency for Healthcare Research and Quality. 2010.
12. Billings J, Zeitel L, Lukomnik J, Carey T, Blank A, Newman L. Impact of socioeconomic status on hospital use in New York City. *Health Aff (Millwood)*. 1993; 12(1): 162-173.
13. Culler S, Parchman M, Przybylski M. Factors related to potentially preventable hospitalizations among the elderly. *Med Care*. 1998; 36(6): 804-817.
14. Overview, background/introduction to algorithm. The Center for Health and Public Service Research Web site. <http://wagner.nyu.edu/faculty/billings/nyued-background>. Accessed May 2, 2016.
15. Weinick J, Billings J, Burstin H. What is the role of primary care in emergency department

overcrowding?. Overcrowded Emergency Rooms: Do We Need More Capacity or Fewer Patients?. Waltham, MA. 2002.

16. Billings J, Parikh N, Mijanovich T. Emergency department use in New York City: A substitute for primary care?. The Commonwealth Fund. March 2000.

17. Simon A. 2013 Minnesota Health Access Survey: Ramsey County. Ramsey County Access to Health Services Action Team. 2014.

18. An Introductory Analysis of Potentially Preventable Health Care Events in Minnesota. Minnesota Department of Health, Health Economics Program. 2015.

19. Baker D, Stevens C, Brook R. Regular source of ambulatory care and medical care utilization by patients presenting to a public hospital emergency department. JAMA. 1994; 271: 1909-1912.

20. Pines J, Lotrecchiano G, Zocchi M, Lazar D. Development of a conceptual model for management of acute, unscheduled care in the United States. The George Washington University Office for Clinical Practice Innovation. 2015.

21. Uscher-Pines L, Pines J, Kellermann A, Gillen E, Mehrotra A. Emergency department visits for nonurgent conditions: Systematic literature review. Am J Manag Care. 2013; 19(1): 47-59.

# Appendix Tables

Appendix Table A: Total ED visits resulting in hospital admission by selected patient characteristics: Ramsey County, 2010-2014

Selected characteristic	Number of visits	Percent distribution	Admissions as percent of visits
<b>All admissions</b>	153,264	100.0%	17.0%
<b>Age</b>			
0-17yrs	11,163	7.3%	1.2%
18-24yrs	8,087	5.3%	0.9%
25-34yrs	13,701	8.9%	1.5%
35-44yrs	14,539	9.5%	1.6%
45-54yrs	21,911	14.3%	2.4%
55-64yrs	22,688	14.8%	2.5%
65-74yrs	19,797	12.9%	2.2%
75-84yrs	22,385	14.6%	2.5%
85+yrs	18,993	12.4%	2.1%
<b>Sex</b>			
Female	80,683	52.6%	9.0%
Male	72,581	47.4%	8.1%
<b>Expected Primary Payer</b>			
Uninsured	2,847	1.9%	0.3%
Public Ins	45,189	29.5%	5.0%
Group/Ind Ins	37,440	24.4%	4.2%
Other Payers	2,779	1.8%	0.3%
Medicare	65,009	42.4%	7.2%
<b>ZIP code</b>			
55101	4,017	2.6%	0.4%
55102	8,056	5.3%	0.9%
55103	5,559	3.6%	0.6%
55104	12,150	7.9%	1.3%
55105	4,418	2.9%	0.5%
55106	17,751	11.6%	2.0%
55107	4,937	3.2%	0.5%
55108	2,744	1.8%	0.3%
55109	11,091	7.2%	1.2%
55110	10,908	7.1%	1.2%
55112	12,962	8.5%	1.4%
55113	12,080	7.9%	1.3%
55114	671	0.4%	0.1%
55116	6,373	4.2%	0.7%
55117	12,762	9.7%	1.4%
55119	10,957	7.2%	1.2%
55126	5,896	3.9%	0.7%
55127	4,050	2.6%	0.4%
55130	5,879	3.8%	0.7%

Appendix Table B: Twenty leading primary diagnostic groups for total ED visits, by patient age and sex: Ramsey County residents, 2010-2014

	Principle diagnostic group	Number of visits	Percent distribution	U.S.
All visits		900,050	100	
All visits, under 15 years		182,525	100	
Females		84,202	46.1	46
	Other upper respiratory infections	12,057	14.3	
	Otitis media and related conditions	5,762	6.8	
	Fever of unknown origin	5,479	6.5	
	Other injuries/conditions due to external causes	4,800	5.7	
	Nausea and vomiting	3,186	3.8	
	Asthma	2,690	3.2	
	Open wounds of head; neck; and trunk	2,579	3.1	
	Superficial injury; contusion	2,373	2.8	
	Other lower respiratory disease	2,321	2.8	
	Other gastrointestinal disorders	2,264	2.7	
	Allergic reactions	2,248	2.7	
	Pneumonia	2,192	2.6	
	Abdominal pain	2,165	2.6	
	Viral infection	2,124	2.5	
	Acute bronchitis	1,704	2	
	Inflammation; infection of eye	1,373	1.6	
	Noninfectious gastroenteritis	1,353	1.6	
	Urinary tract infections	1,336	1.6	
	Skin and subcutaneous tissue infections	1,184	1.4	
	Open wounds of extremities	1,182	1.4	
	All other diagnoses	60,372	0.7	
Males		98,323	53.9	54
	Other upper respiratory infections	13,655	13.9	
	Otitis media and related conditions	6,722	6.8	
	Other injuries/conditions due to external causes	5,967	6.1	
	Fever of unknown origin	5,864	6	
	Open wounds of head; neck; and trunk	4,788	4.9	
	Asthma	4,476	4.6	
	Nausea and vomiting	3,427	3.5	
	Other lower respiratory disease	2,967	3	
	Superficial injury; contusion	2,950	3	
	Pneumonia	2,675	2.7	
	Allergic reactions	2,361	2.4	
	Other gastrointestinal disorders	2,348	2.4	
	Viral infection	2,337	2.4	
	Acute bronchitis	2,291	2.3	
	Fracture of upper limb	1,953	2	
	Abdominal pain	1,931	2	
	Open wounds of extremities	1,753	1.8	
	Noninfectious gastroenteritis	1,663	1.7	
	Inflammation; infection of eye	1,519	1.5	
	Skin and subcutaneous tissue infections	1,321	1.3	
	All other diagnoses	72,968	0.7	
All visits, age 15 - 64 years		579,603	100	
Females		333,172	57.5	57.9
	Abdominal pain	28,641	8.6	
	Headache; including migraine	14,961	4.5	
	Back Pain	14,258	4.3	
	Nonspecific chest pain	12,991	3.9	
	Other complications of pregnancy	12,186	3.7	
	Other upper respiratory infections	10,113	3	
	Sprains and strains	9,401	2.8	

	Mood disorders	9,340	2.8	
	Urinary tract infections	8,733	2.6	
	Other lower respiratory disease	8,693	2.6	
	Other injuries/conditions due to external causes	8,495	2.6	
	Other connective tissue disease	8,035	2.4	
	Superficial injury; contusion	8,012	2.4	
	Other non-traumatic joint disorders	7,508	2.3	
	Disorders of teeth and jaw	6,640	2	
	Other nervous system disorders	6,055	1.8	
	Nausea and vomiting	5,877	1.8	
	Skin and subcutaneous tissue infections	5,194	1.6	
	Open wounds of extremities	5,026	1.5	
	Asthma	4,554	1.4	
	All other diagnoses	194,713	0.6	
Males		246,431	42.52	42.1
	Back Pain	11,269	4.6	
	Abdominal pain	10,994	4.5	
	Nonspecific chest pain	10,813	4.4	
	Other injuries/conditions due to external causes	9,044	3.7	
	Open wounds of extremities	8,493	3.5	
	Mood disorders	8,478	3.4	
	Sprains and strains	7,851	3.2	
	Superficial injury; contusion	7,508	3.1	
	Other connective tissue disease	6,700	2.7	
	Other non-traumatic joint disorders	6,621	2.7	
	Other lower respiratory disease	6,450	2.6	
	Disorders of teeth and jaw	5,957	2.4	
	Alcohol-related disorders	5,824	2.4	
	Schizophrenia and other psychotic disorders	5,360	2.2	
	Skin and subcutaneous tissue infections	5,203	2.1	
	Other upper respiratory infections	5,190	2.1	
	Headache; including migraine	5,090	2.1	
	Open wounds of head; neck; and trunk	4,758	1.9	
	Other nervous system disorders	4,456	1.8	
	Residual codes; unclassified	4,212	1.7	
	All other diagnoses	140,271	0.6	
All visits, age 65 years and over		137,922	100	
Females		82,284	59.7	59.9
	Nonspecific chest pain	4,023	4.9	
	Cardiac dysrhythmias	2,823	3.4	
	Urinary tract infections	2,674	3.3	
	Abdominal pain	2,401	2.9	
	Back Pain	2,318	2.8	
	Congestive heart failure	2,172	2.6	
	Septicemia	2,053	2.5	
	Other injuries/conditions due to external causes	1,961	2.4	
	Superficial injury; contusion	1,884	2.3	
	Other lower respiratory disease	1,882	2.3	
	Conditions associated with dizziness	1,873	2.3	
	Other connective tissue disease	1,861	2.3	
	Other non-traumatic joint disorders	1,762	2.1	
	Pneumonia	1,733	2.1	
	Acute cerebrovascular disease	1,699	2.1	
	Syncope	1,589	1.9	
	Chronic obstructive pulmonary disease	1,565	1.9	
	Other gastrointestinal disorders	1,505	1.8	
	Other nervous system disorders	1,458	1.8	
	Hip Fracture	1,382	1.7	
	All other diagnoses	40,618	0.5	
Males		55,638	40.3	40.1
	Nonspecific chest pain	2,352	4.2	
	Septicemia	1,956	3.5	



Cardiac dysrhythmias	1,925	3.5
Congestive heart failure	1,737	3.1
Pneumonia	1,383	2.5
Abdominal pain	1,318	2.4
Genitourinary symptoms	1,279	2.3
Acute cerebrovascular disease	1,232	2.2
Other lower respiratory disease	1,227	2.2
Back Pain	1,201	2.2
Other injuries/conditions due to external causes	1,186	2.1
Chronic obstructive pulmonary disease	1,138	2.1
Complication of device; implant	1,086	2
Syncope	1,079	1.9
Urinary tract infections	1,070	1.9
Other connective tissue disease	1,063	1.9
Superficial injury; contusion	1,015	1.8
Other nervous system disorders	971	1.8
Conditions associated with dizziness	962	1.7
Acute myocardial infarction	948	1.7
All other diagnoses	26,128	0.5

Appendix Table C: Potentially preventable ED visits per 100 population by ZIP code, Ramsey County, 2010-2014

ZIP Code	Age Group	Visits	Percent Distribution	Number of Visits per 100 population
55101	Under 5	901	8.5%	423.0
	5-9	365	3.5%	419.5
	10-14	162	1.5%	238.2
	15-19	464	4.4%	365.4
	20-24	1208	11.4%	257.6
	25-34	2173	20.6%	106.9
	35-44	1536	14.5%	184.0
	45-54	2125	20.1%	310.7
	55-59	664	6.3%	169.0
	60-64	321	3.0%	90.4
	65-74	397	3.8%	92.8
	75-84	189	1.8%	67.3
	85 and over	61	0.6%	234.6
	Total	10566	100.0%	176.1
55102	Under 5	1824	9.3%	240.3
	5-9	683	3.5%	90.6
	10-14	384	2.0%	76.6
	15-19	807	4.1%	124.3
	20-24	2032	10.4%	143.9
	25-34	3778	19.4%	95.8
	35-44	3023	15.5%	156.1
	45-54	3454	17.7%	132.5
	55-59	1366	7.0%	102.0
	60-64	655	3.4%	56.2
	65-74	753	3.9%	57.0
	75-84	443	2.3%	60.2
	85 and over	307	1.6%	79.5
	Total	19509	100.0%	111.4
55103	Under 5	3081	16.7%	235.4
	5-9	1287	7.0%	118.6
	10-14	680	3.7%	68.8
	15-19	1046	5.7%	88.4
	20-24	2046	11.1%	151.8
	25-34	3410	18.5%	180.6
	35-44	2375	12.9%	164.2
	45-54	2223	12.0%	143.6
	55-59	892	4.8%	113.9
	60-64	570	3.1%	94.2
	65-74	465	2.5%	72.5
	75-84	290	1.6%	85.0
	85 and over	107	0.6%	87.7
	Total	18472	100.0%	139.0
55104	Under 5	5770	15.8%	174.7
	5-9	2225	6.1%	74.6
	10-14	1080	3.0%	41.0
	15-19	2239	6.1%	66.0
	20-24	4355	11.9%	72.5
	25-34	6827	18.7%	83.2
	35-44	4554	12.5%	83.7
	45-54	4244	11.6%	79.4
	55-59	1592	4.4%	64.1
	60-64	968	2.7%	49.8
	65-74	1271	3.5%	52.3
	75-84	840	2.3%	90.2
	85 and over	484	1.3%	121.6
	Total	36449	100.0%	80.1
55105	Under 5	637	9.4%	45.5

	5-9	313	4.6%	22.1
	10-14	221	3.3%	14.4
	15-19	419	6.2%	13.0
	20-24	746	11.1%	27.2
	25-34	1220	18.1%	29.4
	35-44	747	11.1%	24.9
	45-54	852	12.6%	24.5
	55-59	346	5.1%	17.6
	60-64	330	4.9%	17.1
	65-74	377	5.6%	22.8
	75-84	330	4.9%	43.0
	85 and over	209	3.1%	67.6
	Total	6747	100.0%	24.5
55106	Under 5	9900	17.9%	170.6
	5-9	3835	6.9%	69.5
	10-14	2079	3.8%	45.0
	15-19	3466	6.3%	81.0
	20-24	6283	11.3%	139.6
	25-34	10970	19.8%	121.1
	35-44	6886	12.4%	90.0
	45-54	5830	10.5%	89.7
	55-59	1933	3.5%	72.5
	60-64	1295	2.3%	65.4
	65-74	1401	2.5%	67.3
	75-84	931	1.7%	78.8
	85 and over	590	1.1%	94.1
	Total	55399	100.0%	98.1
55107	Under 5	2844	17.9%	243.1
	5-9	1281	8.1%	111.4
	10-14	701	4.4%	46.6
	15-19	1083	6.8%	99.2
	20-24	1754	11.1%	137.7
	25-34	2867	18.1%	131.3
	35-44	1889	11.9%	86.3
	45-54	1488	9.4%	71.2
	55-59	516	3.3%	86.3
	60-64	380	2.4%	54.3
	65-74	534	3.4%	72.7
	75-84	316	2.0%	70.1
	85 and over	204	1.3%	50.1
	Total	15857	100.0%	102.0
55108	Under 5	524	11.7%	59.5
	5-9	201	4.5%	31.8
	10-14	82	1.8%	12.4
	15-19	266	5.9%	17.2
	20-24	603	13.4%	32.4
	25-34	864	19.2%	28.1
	35-44	469	10.4%	26.2
	45-54	429	9.5%	27.0
	55-59	188	4.2%	27.9
	60-64	164	3.6%	19.7
	65-74	234	5.2%	24.5
	75-84	253	5.6%	54.2
	85 and over	219	4.9%	48.9
	Total	4496	100.0%	29.2
55109	Under 5	2799	13.1%	118.6
	5-9	1075	5.0%	53.8
	10-14	632	3.0%	36.0
	15-19	1195	5.6%	79.2
	20-24	2322	10.9%	107.1
	25-34	3700	17.3%	76.8
	35-44	2592	12.1%	68.8

	45-54	2366	11.1%	52.7
	55-59	943	4.4%	40.8
	60-64	739	3.5%	38.1
	65-74	1186	5.5%	51.1
	75-84	1097	5.1%	61.9
	85 and over	732	3.4%	77.1
	Total	21378	100.0%	66.5
55110	Under 5	1485	9.4%	67.6
	5-9	752	4.8%	30.9
	10-14	488	3.1%	20.2
	15-19	820	5.2%	37.4
	20-24	1386	8.8%	79.5
	25-34	2601	16.5%	58.7
	35-44	1899	12.0%	43.1
	45-54	2027	12.8%	34.7
	55-59	829	5.3%	26.4
	60-64	654	4.1%	20.8
	65-74	1074	6.8%	30.0
	75-84	1123	7.1%	51.8
	85 and over	650	4.1%	71.0
	Total	15788	100.0%	40.9
55112	Under 5	2806	12.5%	88.5
	5-9	1154	5.1%	47.4
	10-14	651	2.9%	29.3
	15-19	1084	4.8%	31.2
	20-24	2246	10.0%	69.2
	25-34	4485	20.0%	72.4
	35-44	2730	12.2%	56.5
	45-54	2515	11.2%	41.7
	55-59	866	3.9%	29.6
	60-64	723	3.2%	29.4
	65-74	1265	5.6%	34.4
	75-84	1253	5.6%	49.7
	85 and over	686	3.1%	75.6
	Total	22464	100.0%	50.9
55113	Under 5	2098	12.1%	103.7
	5-9	818	4.7%	41.3
	10-14	515	3.0%	24.9
	15-19	742	4.3%	32.7
	20-24	1558	9.0%	47.0
	25-34	2766	15.9%	45.2
	35-44	1830	10.5%	46.0
	45-54	2005	11.5%	38.2
	55-59	852	4.9%	32.9
	60-64	717	4.1%	35.7
	65-74	1144	6.6%	30.3
	75-84	1278	7.3%	49.1
	85 and over	1069	6.1%	64.3
	Total	17392	100.0%	43.9
55114	Under 5	141	8.2%	81.0
	5-9	65	3.8%	108.3
	10-14	30	1.8%	38.0
	15-19	64	3.7%	44.8
	20-24	219	12.8%	32.0
	25-34	426	24.9%	42.3
	35-44	219	12.8%	121.0
	45-54	277	16.2%	71.0
	55-59	106	6.2%	84.1
	60-64	69	4.0%	38.5
	65-74	55	3.2%	64.7
	75-84	32	1.9%	123.1
	85 and over	7	0.4%	38.9

	Total	1710	100.0%	54.2
55116	Under 5	1597	15.1%	120.8
	5-9	599	5.7%	51.2
	10-14	320	3.0%	18.8
	15-19	349	3.3%	25.4
	20-24	806	7.6%	51.6
	25-34	1744	16.5%	44.7
	35-44	1197	11.3%	34.4
	45-54	1137	10.8%	34.8
	55-59	543	5.1%	28.9
	60-64	475	4.5%	31.8
	65-74	620	5.9%	48.1
	75-84	635	6.0%	53.1
	85 and over	537	5.1%	71.1
	Total	10559	100.0%	43.3
55117	Under 5	6490	17.4%	195.3
	5-9	2486	6.7%	88.1
	10-14	1287	3.4%	41.2
	15-19	2348	6.3%	65.9
	20-24	4324	11.6%	112.9
	25-34	6962	18.6%	107.0
	35-44	4452	11.9%	86.9
	45-54	4124	11.0%	74.1
	55-59	1455	3.9%	55.3
	60-64	884	2.4%	40.4
	65-74	1117	3.0%	52.3
	75-84	865	2.3%	58.1
	85 and over	537	1.4%	85.9
	Total	37331	100.0%	87.0
55119	Under 5	4905	16.5%	141.5
	5-9	1799	6.1%	64.4
	10-14	1092	3.7%	39.1
	15-19	1725	5.8%	64.9
	20-24	3050	10.3%	93.8
	25-34	5572	18.8%	81.2
	35-44	3406	11.5%	74.1
	45-54	3589	12.1%	61.3
	55-59	1190	4.0%	47.7
	60-64	839	2.8%	43.6
	65-74	1117	3.8%	54.3
	75-84	956	3.2%	76.8
	85 and over	443	1.5%	89.3
	Total	29683	100.0%	73.3
55126	Under 5	646	8.2%	46.3
	5-9	336	4.3%	23.4
	10-14	199	2.5%	13.0
	15-19	413	5.2%	29.4
	20-24	681	8.6%	53.0
	25-34	1183	15.0%	39.5
	35-44	1000	12.7%	32.1
	45-54	987	12.5%	25.4
	55-59	499	6.3%	20.0
	60-64	370	4.7%	17.5
	65-74	654	8.3%	27.3
	75-84	540	6.8%	44.4
	85 and over	393	5.0%	77.1
	Total	7901	100.0%	30.6
55127	Under 5	448	8.3%	50.5
	5-9	174	3.2%	24.0
	10-14	124	2.3%	15.6
	15-19	267	4.9%	25.3
	20-24	352	6.5%	59.0

	25-34	798	14.7%	41.5
	35-44	655	12.1%	40.0
	45-54	661	12.2%	22.9
	55-59	355	6.5%	20.8
	60-64	315	5.8%	20.5
	65-74	516	9.5%	27.5
	75-84	482	8.9%	46.1
	85 and over	278	5.1%	50.3
	Total	5425	100.0%	31.5
55130	Under 5	3900	18.2%	296.6
	5-9	1544	7.2%	93.1
	10-14	813	3.8%	58.3
	15-19	1436	6.7%	119.9
	20-24	2395	11.2%	157.8
	25-34	3860	18.0%	136.1
	35-44	2750	12.8%	131.8
	45-54	2435	11.4%	160.7
	55-59	783	3.7%	88.2
	60-64	599	2.8%	79.3
	65-74	532	2.5%	81.1
	75-84	267	1.2%	130.2
	85 and over	95	0.4%	77.9
	Total	21409	100.0%	132.6