**Necessity of ED-Based Outpatient Infusion Services as a Stewardship Program**

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Abstract:

**Background**

Infusion centers provide longitudinal chronic disease management of numerous conditions. Emergency departments have experienced patient visits for receipt of normally infusion-center based care. The purpose of this study was to assess the necessity and feasibility of implementing an outpatient infusion service within the emergency department (ED) for when the institution’s outpatient infusion center is unavailable.

**Methods**

This was a retrospective, single-site chart review of patients seen in the ED or clinical decision unit (CDU) for the sole purpose of being administered a medication or blood product from July 1, 2022 to June 30, 2023. The primary outcome was quantification of total cost associated with the ED visits as compared to cost for an infusion center visit of the same type.

**Results**

There were 90 administrations that met criteria during the study period. These administrations were associated with 86 separate ED encounters. The total estimated cost related to these encounters was $150,414. The estimated cost for these administrations to occur in the infusion center setting was $45,990, totaling a potential cost savings of $104,424. The most frequent reason for ED encounters related to these administrations was receipt of STI exposure treatment, rabies prophylaxis, and methotrexate administration for ectopic pregnancy which collectively comprised 92.2% of administrations.

**Conclusion**

Avoidance of unnecessary ED visits can be associated with significant cost savings. Based on the reasons for ED presentation for administrations, implementation of an ED-based outpatient infusion service is not needed for prevention of these unnecessary visits.

Keywords: emergency department, infusion center

1. Background

Infusion centers allow for management of multiple chronic conditions under the supervision of healthcare professionals outside of the hospital setting. Infusion centers provide outpatient disease management to patients in a more convenient and cost-effective manner as compared to hospital-based management.1 Comparisons of infusion center and emergency department (ED) care have been performed for multiple disease states including vaso-occlusive crises (VOC), migraines, and chemotherapy side effects.2-6 The ESCAPED trial found that receipt of care in the infusion center led to significant reductions in time to first dose of parenteral pain medication administration and were also significantly more likely to have pain reassessed within 30 minutes. Patients in this study were furthermore significantly less likely to be admitted to the hospital for an episode of uncomplicated VOC and reported significantly more satisfaction with care within an infusion center.2,3 Evaluations of migraine management have shown that ED presentations related to migraines are associated with an average length of stay of 5 days and a total average cost of $6908 as compared to an average migraine outpatient visit cost of $139.4,5 These large cost differences are attributable to the usage of unnecessary radiographic scans and use of non-migraine-specific medications within the ED setting. Implementation of an infusion center for management of symptoms associated with chemotherapy have shown reductions in ED visits for oncology-related complaints and chemotherapy symptom management following implementation.6 Infusion center-based care is consistently associated with improvements in time to patients receiving proper care, increased patient satisfaction in their care, as well as decreases in hospitalization rates associated with the chronic condition significantly reducing healthcare costs.

At Renown Regional Medical Center (RRMC), factors such as limited infusion center hours and lack of immediate availability of infusion center chairs have led to ED presentations for provision of infusion-center based care. The organization’s infusion center is currently operating at 100% capacity with an average wait time for appointments of 7 days. A potential strategy for overcoming barriers to receipt of infusion center-based care is implementation of an outpatient infusion service within the ED space. Highlighted by a 2022 study by Graham and colleagues, implementation of an ED-embedded infusion service allowed for administration of COVID-19 antibody treatments without utilization of an ED visit.7 Given the reports of ED visits for infusion center-based care at RRMC and evidence showing improved and more cost-effective care within infusion centers our goal was to assess the necessity and feasibility of implementing an outpatient infusion service within the ED space for when the institution’s outpatient infusion center is unavailable.

**2. Methods**

This was a retrospective, single-site review of patients seen in the ED or clinical decision unit (CDU) for medication administration that could have been administered through an infusion center. Patients presenting to the ED between July 1, 2022 to June 30, 2023 were evaluated. Patients were included if they presented to the ED for the sole purpose of being administered a medication or blood product without any further complicating medical condition requiring evaluation or hospitalization. Patients were excluded if they transferred in from other healthcare facilities or prisons or if their length of stay was greater than 48 hours. The medications considered for evaluation are shown in Table 1. These medications were selected based on the services and types of diseases typically managed within an infusion center.

The primary endpoint of this study was the quantification of total costs associated with the ED visits for administration of the identified medications/blood products as compared to the infusion center costs for a visit of the same type. Estimated ED visit costs were calculated based on national averages from the 2019 Consumer Health Ratings Report showing the average cost of an ED visit as $1,749.8 Equivalent infusion center costs were calculated based on Renown infusion center charges shown in Table 2 for different appointment types.

***2.1 Data Collection***

Data was collected via the electronic medical record. Data collected included medication administered, chief complaint, discharge problem list, and length of stay.

***2.2 Data Analysis***

Data was analyzed using descriptive statistics.

**3. Results**

There were 606 administrations of studied medications given during the study period in the ED. 516 of these administrations were excluded. Reasons for exclusion included patients having another acute medical problem noted in their chief complaint or problem list during the encounter (n=468) and for having a length of stay greater than 48 hours (n=48). After exclusion, there were 90 administrations that met criteria for analysis in the study (Figure 1). The breakdown of the 90 administrations that met criteria are shown in Figure 2. A majority of administrations were intramuscular (IM) ceftriaxone (57.8% of administrations), IM methotrexate was the second most frequent (16.7% of administrations), and the combination of rabies vaccine and rabies immune globulin were the third most frequent (12.2% of administrations). The only blood product administration that was able to be successfully captured was Rhophylac®.

The 90 administrations that met criteria comprised 86 separate ED encounters as 4 encounters included administration of both rabies vaccine and rabies immune globulin. The average length of ED stay for these encounters was 2.8 hours (range 0.72-8.1 hours) with a total time of ED bed occupancy of 234 hours. The total estimated costs for these 86 ED visits came to a total of $150,414 based on the previously described estimated average cost per ED visit.

*Figure 1: Diagram of the study population*

For cost comparison the medication administrations in the ED were classified as corresponding infusion center visit types shown in Table 3. A majority (90%) of the administrations that met criteria were classified as the sub-Q/IM administration visit type. Based on the costs associated with each corresponding infusion center visit type the total cost associated with the study medications in the infusion center setting was estimated to be $45,990.

The estimated cost of the 90 medication administrations in the ED totaled $150,414 while the comparable cost for the administrations to occur at the infusion center was estimated to be $45,990. The estimated cost for these administrations to occur in the infusion totals a potential cost savings of $104,424 annually.

**4. Discussion**

The results of this study highlight that avoidance of unnecessary ED visits can be associated with significant annual cost savings. After reviewing the medications administered and reasons for administration within the ED, it was determined that implementation of an ED-Based outpatient infusion service is not needed for prevention of unnecessary ED visits.

Table 4 highlights the reasons for ED presentation for the studied medication administrations identified during manual chart review. The number of ED visits related to infusion center unavailability only totaled a small proportion (5.6%) of the ED medication administrations identified, representing an overall small proportion of the total costs incurred by these visits.

Unnecessary ED visits can best be avoided through utilization of already available resources instead of through implementing an ED-based outpatient infusion service. Sexually transmitted infection (STI) exposure treatment and rabies post exposure prophylactic treatment comprised the largest proportion (total 74.4%) of associated ED administrations. These unnecessary ED visits can successfully be avoided through increased collaboration with the local Northern Nevada Health Department for facilitation of follow-up STI treatment and rabies post-exposure prophylaxis. Encounters related to methotrexate administration for ectopic pregnancy comprised the second largest proportion (16.7%) of total ED administrations. At Renown Regional Medical Center planning and development are currently in process for a collaborative practice agreement between pharmacy and obstetrics that will allow for the management of all ectopic methotrexate through the infusion center, further reducing unnecessary ED visits. Utilization of these already available resources will allow for reductions in costs associated with unnecessary ED visits without the additional cost, labor, training, and physical space requirements needed for implementation of an infusion center within the ED space.

***4.1 Limitations***

Limitations to this study include the use of nation-wide averages for ED visit costs versus institution-specific data as this would have given a more accurate estimation of cost savings. Additionally, the inability to capture additional costs associated with the ED visits including labs and imaging would have additionally provided further accuracy to estimation of cost savings. Another limitation was the inability to collect blood product administrations besides Rhophylac® such as packed red blood cell or platelet infusions that would have further impacted cost data.

**5. Conclusion**

Outpatient infusion center-based administration of medications is associated with improvements in patient care as well as decreased healthcare costs as compared to the ED. Our study highlights the potential for avoidance of ED visits that can be associated with significant cost savings. Based on the reasons for ED presentation for administrations at our facility, implementation of an ED-based outpatient infusion service is not needed for prevention of these unnecessary visits.

Conflicts of Interest

The authors of this manuscript have nothing to disclose and no conflicts of interest.

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Table 1: Medications considered for evaluation in study.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Antibiotics** | **Migraine Management** | **OBGYN Management** | **COVID Treatments** | **Post-Exposure Prophylaxis** | **Miscellaneous** |
| Penicillin G IM | Caffeine sodium benzoate | Methotrexate IM | Bamlanivimab | Rabies immune globulin | Intravenous immune globulin |
| Gentamicin IM | Dihydroergotamine injection | Rhophylac® | Bamlanivimab/estesevimab | Rabies vaccine | Iron dextran |
| Ceftriaxone IM | Sumatriptan injection |  | Bebtelovimab | Hepatitis B immune globulin | Paliperidone palmitate |
| Daptomycin |  | Casirivimab/ imdevimab |  |  |
| Ertapenem | Sotrovimab |
|  | Remdesivir |

Table 2: Charges for different visit types at Renown infusion center

|  |  |
| --- | --- |
| **Visit Type** | **Cost** |
| Infusion Visit | $1,463 |
| IV Hydration Visit | $1,463 |
| Sub-Q/IM Administration Visit | $443 |
| Blood Product Administration Visit | $2,838 |

Table 3: Classifications of medications administered in the ED to a corresponding infusion center visit type.

|  |  |
| --- | --- |
| **Infusion Visit** | **Sub-Q/IM Administration Visit** |
| Bebtelovimab  Daptomycin  Ertapenem | Ceftriaxone IM  Gentamicin IM  Methotrexate IM  Paliperidone IM  Penicillin G IM  Rabies Vaccine  Rabies Immune Globulin  Rhophylac® |
| Total: n=6 (10%) | Total: n=84 (90%) |

Table 4: Reasons for ED presentation for administration of studied medications.

|  |  |
| --- | --- |
| **Reason for ED Presentation** | **Frequency (% of total administrations)** |
| Request for treatment following STI exposure notification | 62.2% |
| Ectopic pregnancy initial treatment or follow-up dosing | 16.7% |
| Rabies prophylaxis | 12.2% |
| Infusion center unavailability or unavailability of outpatient follow-up | 5.6% |
| Physician referral to ED for infusion administration | 3.3% |

Figure 2: Breakdown of medication administrations that met inclusion criteria by agent.