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ANALYSIS OF INTRAMUSCULAR INJECTIONS ADMINISTERED IN A FAMILY HEALTH CENTER

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Abstract

Objectives: In this study, the objective was to evaluate the intramuscular injections administered to patients admitted to a family health center with sociodemographic characteristics.

Materials and Methods: This is a cross-sectional, analytical and, retrospective file review study. The sample population was formed by patients who had intramuscular injections administered between the dates of January 01, 2017 – and December 31, 2019. A total of 5648 injections for 2059 adults/children were evaluated. The data set was analyzed using SPSS 17.0 (IBM, USA) statistical package program.

Results: An average of 2.74 injections per person was administered. The rate of myorelaxant injection administration was higher among women ($p<0.001$), and the rate of antibiotic and analgesic + myorelaxant injection administrations was higher among men ($p<0.001$ for both). With the increase of age, the rate of analgesic injection administrations increases ($p<0.001$) and the rate of antibiotic injection administrations decreases ($p<0.001$). The highest analgesic + myorelaxant injection administration rate was during autumn, and the lowest was during winter ($p=0.001$).

Conclusion: The results showed that the frequency of analgesic, myorelaxant, antibiotic, steroid, vitamin/mineral, hormone and combination drugs used for intramuscular injection were affected by demographic variables such as age, gender and season. Identifying family health center dynamics may contribute to creating rational health policies.

Keywords: Intramuscular, injection, family medicine, demographic.

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Introduction

Injection is the most commonly used form of pharmacological treatment. Intramuscular (IM) injections are one of the most prevalently used methods in injection applications.[1] IM injection is the method used to administer medication to large muscle masses with a sterile needle, and it is routinely performed in almost all medical disciplines.[2] Generally, it is used for increasing the speed of the medication's effect or when the oral form is irritating.[3] IM injection is used widely in inpatient treatment institutions and is administered to healthy/ill individuals during vaccination and outpatient treatments in primary health care services.[1] Worldwide, 12 billion treatments are administered annually by injection.

Moreover, 5% or less of these are vaccinations, and >95% are injections for treatment.[3] In the literature, there are many studies on which diagnosis, how often, type of health institutions, anatomical localizations injections are applied and what side effects it may cause.[4-6] Apart from routine, this study aimed to evaluate IM injections administered to patients who applied to a family health center (FHC) with sociodemographic characteristics.

Materials and Methods

Study design

This is a cross-sectional, analytical and, retrospective file review study. A total of 5648 injections of 2059 different individuals were evaluated.

Case selection

The study universe was formed by 17,000 individuals registered to the 'Asarcık Meydan FHC' identified as a primary healthcare institution providing service in the Asarcık district[7] located in a rural area connected to the city of Samsun on the coast of Turkey, 44 kilometers south of the city center with an area of 214 square kilometers. The sample population was formed by patients who had IM injections administered between January 01, 2017 – December 31, 2019.

Five doctors and eight assistant healthcare personnel worked in this FHC and all data were archived by them. Without the need for sample analysis, age, gender, injection date and content of the administered drug were recorded for all patients, except those who lacked information. Vaccine applications were also excluded, and name or identification numbers were not specified. The nurses got the injections of the patients who applied with various diagnoses.

Statistical analysis

Graph representations were used to reveal the change in the number of injections according to sex, age, season and months. Chi-square analyses were used to determine the significance and the degree of the relationship between two qualitative variables. The ratio test determined the differences between the categories of demographic variables. Moreover, to determine the variables that affect the distribution of the number of injections, multiple correspondence analysis was used to determine the relationship and correspondence between the categories by bringing the levels of all categorical variables together on the same plane. The acquired data set was analyzed using SPSS 17.0 (IBM, USA) statistical package program, and the significance level was accepted as $p<0.05$.

Results

In this study, an average of 2.74 injections (min:1 – max:6) per person was administered. Female gender, 43-65 years of age and use of analgesics were predominant (Table 1).

The rate of myorelaxant injection administration was higher among women ($p<0.001$), and the rate of antibiotic and analgesic + myorelaxant injection administrations was higher among men ($p<0.001$ and $p<0.001$, respectively) (Table 2).

With the increase of age, the rate of analgesic injection administrations increases ($p<0.001$) and the rate of antibiotic injection administrations decreases ($p<0.001$), contingency coefficient = 0.514 for both comparisons. Steroid injection administration rates were found to be the highest among the 19–42 age group and at lowest among the 0–18 age group ($p<0.001$). Vitamin/mineral injection administration rates were reported to be the highest among the 0–18 age group and the lowest among the 43–65 age group ($p<0.001$). The administration rate of injections containing hormones was highest among the 19–42 age group ($p<0.001$). Administration of analgesic + myorelaxant injection increased until the age of 65, but there was a decrease after the age of 65 ($p<0.001$) (Table 3).

As the summer season approached, the rate of analgesic injection and myorelaxant injection administrations decreased ($p<0.001$, $p = 0.006$, respectively). The rate of antibiotic injections, which showed an increase from autumn to spring, decreased in the summer ($p=0.004$). The highest rate of steroid injection administration was during summer and autumn; the lowest was during the winter season ($p = 0.003$). The highest rate of vitamin/mineral injection administration was during the summer; the lowest was during the spring ($p=0.002$). The highest administration rate of injections containing hormones was during autumn and winter, and the least amount of administrations was found to be during spring ($p = 0.001$). The highest rate of analgesic +

myorelaxant injection administration was during winter, and the lowest was during autumn (p = 0.001) (Table 4).

Table 1. Distribution of Injection Medications According to Variables

Variables	Categories	n	% *
Gender	Female	4152	73.51
	Male	1496	26.49
Age	0-18 Years	271	4.80
	19-42 Years	1470	26.03
	43-65 Years	2573	45.56
	+65 Years	1334	23.61
Season	Autumn	1465	25.94
	Winter	1491	26.41
	Spring	1476	26.13
	Summer	1216	21.52
Injection Medications	Analgesic	1395	24.70
	Myorelaxant	270	4.78
	Antibiotic	403	7.14
	Steroid	586	10.38
	Vitamin / Mineral	863	15.28
	Hormone	181	3.20
	Analgesic + Myorelaxant	1764	31.23
	Other	186	3.29
TOTAL		5648	100

* Percentage of the column is shown.

Table 2. Relationship between the Distribution of Number of Injections and Sex*

			Number of Injections		
			Female	**Male**	**Total**
Injection	Analgesic	n	1036_a	359_a	1395
		%	25.06%	24.04%	24.70%
	Myorelaxant	n	234_a	36_b	270
		%	5.63%	2.47%	4.87%
	Antibiotic	n	263_a	140_b	403
		%	6.31%	9.42%	7.13%
	Steroids	n	429_a	157_a	586
		%	10.32%	10.53%	10.42%
	Vitamin / Mineral	n	652_a	211_a	863
		%	15.78%	14.14%	15.39%
	Containing Hormone	n	181_a	0_b	181
		%	4.49%	0.0%	3.25%
	Analgesic + Myorelaxant	n	1236_a	528_b	1764
		%	29.81%	35.32%	31.22%
	Other	n	121_a	65_b	186
		%	2.90%	4.38%	3.32%
TOTAL		n	4152	1496	5648

* p=1.73e-23<0.05.
Each different index letter represents a subset of gender categories, of which the column ratios differ at a statistically significant level.
a-b: Shows from which group in the column related to each other.

While the season variable and gender variable had the same and low separation measures in both dimensions, it was observed that the age variable had more separation effectiveness than these two variables in both dimensions (Figure 1). The effect of season and gender variables, with coordinate values close to zero, on the injection variable was less, while the effect of the age variable on the injection variable was high (Table 5).

It is observed that women got more injections during the summer and spring seasons, and men got more injections during the winter and autumn seasons. The injections for the 0–18 age group were independent of season and sex. The correspondence graph showing all categories on the same coordinate plane is shown in Figure 2.

Table 3. Relationship between the Distribution of Number of Injections and Age *

			Number of Injections				Total
			0-18 Years	19-42 Years	43-65 Years	+65 Years	
Injection	Analgesic	n	8 $_{a}$	222 $_{b}$	741 $_{c}$	424 $_{c}$	1395
		%	3.02%	15.15%	28.84%	31.87%	24.70%
	Myorelaxant	n	5 $_{a}$	67 $_{a}$	139 $_{a}$	59 $_{a}$	270
		%	1.84%	4.63%	5.46%	4.40%	4.81%
	Antibiotic	n	167 $_{a}$	89 $_{b}$	78 $_{c}$	69 $_{b}$	403
		%	61.64%	6.11%	3.01%	5.23%	7.15%
	Steroid	n	12 $_{a}$	176 $_{b}$	256 $_{b}$	142 $_{b}$	586
		%	4.40%	12.02%	9.93%	10.69%	10.41%
	Vitamin / Mineral	n	63 $_{a}$	262 $_{a,b}$	345 $_{c}$	193 $_{b,c}$	863
		%	23.23%	17.84%	13.40%	14.51%	15.33%
	Containing Hormone	n	2 $_{a}$	179 $_{b}$	0 $_{c}$	0 $_{c}$	181
		%	0.72%	12.20%	0.00%	0.00%	3.22%
	Analgesic + Myorelaxant	n	3 $_{a}$	399 $_{b}$	940 $_{c}$	422 $_{b}$	1764
		%	1.11%	27.11%	36.51%	31.64%	31.22%
	Other	n	11 $_{a,b}$	76 $_{b}$	74 $_{a}$	25 $_{a}$	186
		%	4.14%	5.23%	2.95%	1.96%	3.36%
TOTAL		n	271	1470	2573	1334	5648

* p=6.32e-288 <0.05.
Each different index letter represents a subset of age categories, of which the column ratios differ at a statistically significant level.
a-c: Shows from which group in the column related to each other

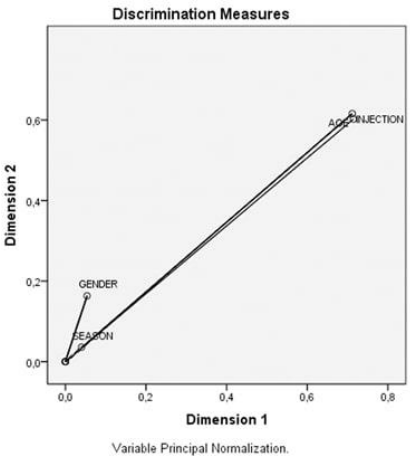

Figure 1. Separation Measures Chart for Variables

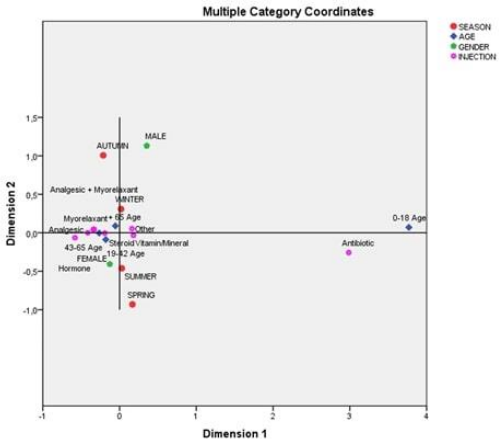

Figure 2. Multiple Category Coordinates Correspondence Chart

Table 4. Relationship between the Distribution of Injection Administrations and Seasons*

			Number of Injections				
			Autumn	**Winter**	**Spring**	**Summer**	**Total**
Injection	Analgesic	n	400 $_{a}$	356 $_{a, b}$	385 $_{a}$	254 $_{b}$	1395
		%	27.31%	23.90%	26.11%	20.95%	24,73%
	Myorelaxant	n	96 $_{a}$	76 $_{a, b}$	61 $_{b, c}$	37 $_{c}$	270
		%	6.62%	5.13%	4.12%	3.02%	4,81%
	Antibiotic	n	65 $_{a}$	117 $_{b, c}$	141 $_{c}$	80 $_{a, b}$	403
		%	4.44%	7.87%	9.62%	6.60%	7.12%
	Steroid	n	161 $_{a. b}$	123 $_{b}$	159 $_{a, b}$	143 $_{a}$	586
		%	11.03%	8.29%	10.85%	11.83%	10,43%
	Vitamin / Mineral	n	219 $_{a}$	223 $_{a}$	184 $_{a}$	237 $_{b}$	863
		%	14.90%	15.00%	12.57%	19.56%	15,30%
	Containing Hormone	n	79 $_{a}$	43 $_{b}$	25 $_{b}$	34 $_{b}$	181
		%	5.42%	2.91%	1.70%	2.80%	3.21%
	Analgesic + Myorelaxant	n	406 $_{a}$	500 $_{b}$	470 $_{a, b}$	388 $_{a, b}$	1764
		%	27.72%	33.53%	31.80%	31.91%	31,26%
	Other	n	39 $_{a}$	53 $_{a}$	51 $_{a}$	43 $_{a}$	186
		%	2.76%	3.67%	3.53%	3.53%	3.34%
TOTAL		n	1465	1491	1476	1216	5648

* p=6.62e-19 <0.05.
Each different index letter represents a subset of season categories, of which the column ratios differ at a statistically significant level.
a-c: Shows from which group in the column related to each other.

Table 5. Central Coordinates of Variables

	Dimension 1	**Dimension 2**
Season	0.040	0.036
Gender	0.054	0,163
Age	0.711	0,616
Injection	0.714	0,602

Discussion

In this primary care study, demographic factors were found to play a decisive role in the distribution of intramuscular injection. It shows the value of this study that it is not easy to reach a study analyzing intramuscular injection administrations in primary healthcare services in the literature. In this way, a statistical photograph of the rural area could be taken.

Primary health care institutions are the first step for all health problems.[8] Therefore, FHC admissions come with a wide range of symptoms and findings. Generally, musculoskeletal pain is at the forefront of IM injection needs.[4] Use of curative injection is common among healthcare professionals and patients. This is supported by studies conducted among patients in outpatient settings in developing countries. However, how much of these are needed is a separate subject of discussion. Antibiotics, vitamins or analgesics are often prescribed by

injection for upper respiratory tract infections, diarrhea, fever, or general fatigue.[9] In this study, the existence of many types of diagnosis for administering IM injection therapy and most of the injections being performed for analgesia support the literature. Skeletal diseases accompanying aging and pain related to obesity are frequently associated with IM analgesic use.[10] The results of this research showed the relationship between aging and this medication. Although the number of analgesic IM injections decreased during summer, the increase in the number of steroid injections may be explained by the increase in the number of pain cases caused by problems such as disc herniation and trauma triggered by physical activity rather than myalgia, which causes relatively milder pain.[11,12] As known, rural areas have their own dynamics different from the urban areas. Reasons, such as the concentration of agricultural activities at certain times of the year, may cause some medications to be used more frequently, whether necessarily or unnecessarily, compared to the patients in the city.[13] The increase in the number of antibiotic injections among children may be a result of the higher prevalence of respiratory tract infections.[14] The age and sex distribution in hormone injections appear to be related to the use of contraception or miscarriage prevention among pregnant women.

According to their study by Garcia et al., the IM administration method was used more among women, people over the age of 50 and those with a very low level of education. Most patients believe that this method is superior to enteric treatments.[15] According to the study by Talaat et al., when pediatric vaccines are excluded, the injection rate is higher among the elderly and women.[16] In a study conducted in Turkey, it was observed that the injection rate increases among patients with low levels of health literacy and among single patients.[17] According to this research, age, sex, and season were concepts that show effectiveness in IM injection. This was thought to be related to sociodemographic situations. In this rural district, men go to work in larger cities to earn money. People are interested in agriculture and animal husbandry. These facts may explain the difference in the parameters involved.

When technique rules are not followed in IM injection applications, many complication risks arise.[18] Unfortunately, home injections can also be found in Turkey. It is therefore important that the injections be made in the FHC. Because although the main task of FHCs is to provide preventive healthcare services, curative healthcare services constitute an important part of daily practice.[19] Vaccines were not included in this study, and analyses were conducted on the injections administered for treatment purposes.

A population-based study in Egypt reported that the average annual number of injections of 4.2 per person is higher compared to other low-income countries.[16] The average per person reported in this research is lower. The difference may be related to rational medication use or sociodemographic differences.

While certain clinicians choose to only perform a few types of musculoskeletal injections, others may inject to any anatomically possible target. Current evidence does not lead us to a definitive point for musculoskeletal

injections.[20] Unless there is an additional situation, the routine practice of FHC professionals is injections into the ventral/dorso-gluteal region. Therefore, statistical analysis was not needed.

In conclusion, one of the unique dynamics of primary health care institutions is that they cater to every segment of society. IM injection is an important curative intervention administered to this broad spectrum of the patient population. In this study, the objective was to roughly determine which patient groups were preferred to administer IM injection. The results showed that the frequency of analgesic, myorelaxant, antibiotic, steroid, vitamin/mineral, hormone and combination drugs used for intramuscular injection were affected by demographic variables such as age, gender and season. Identifying FHC dynamics can contribute to the creation of rational health policies.

Strengths and Limitations

The strengths of the study were the high number of analyzed administrations, study duration spreading over a long period of time and representing only primary healthcare.

Some patients received multiple injections, so the number of injections should not be confused with the number of patients. Also, the fact that the study was single-centered is a limitation in its generalization.

Ethical Considerations: Following the preliminary approval from the responsible physician of the FHC, a study protocol was signed with the provincial health directorate, and approval numbered GOKA/2021/18/9 was obtained from the Samsun Training and Research Hospital non-invasive ethics committee.

Conflict of Interest: The authors declare no conflict of interest. No financial disclosure was declared by the authors.

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