

**PREDICTORS OF PHYSICIANS ACCEPTANCE OF CLINICAL PHARMACY RECOMMENDATIONS AT A MILITARY HOSPITAL IN THE UNITED ARAB EMIRATES**

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ABSTRACT

The objective of the present work is to study the effect of a number of factors on acceptance by clinicians for clinical pharmacy recommendations. Clinical Pharmacy team documented their recommendations since June 2010 till March 2013 in a dedicated excel file. We performed univariate analyses to determine the significance of certain variables in predicting physician's acceptance of recommendations made in 2011. Out of a total 8,451 recommendations documented in our database, 3,871 (45.3%) were made in 2011. Only 1982 (51.2 %) recommendations were fully documented with clinical pharmacist identification and therefore were available for analysis. Overall physician acceptance rate was 81.7%. Factors resulting in a higher acceptance were clinical pharmacy experience of more than 3 years (33% vs. 21%, $P < 0.0001$), board certification (46% vs. 37%, $P = 0.002$), doctor of pharmacy degree (33% vs. 21%, $P < 0.0001$), and post-bachelor professional education (42% vs. 32%, $P = 0.001$). Specialties associated with a significantly higher acceptance were critical care (21% vs. 14%, $P = 0.002$), pediatrics (12% vs. 7%, $P = 0.009$) and oncology (19% vs. 6%, $P < 0.0001$). Recommendations to stop medications were significantly more likely to be accepted (25% vs. 20%, $P = 0.021$). Finally, recommendations concerning anti-infectives were more likely to be accepted (26% vs. 18%, $P = 0.002$). Clinicians acceptance of clinical pharmacy recommendations can be predicted by variables of education, experience, specialty, medication class and type of recommendation. We recommend investing more in clinical pharmacy in the areas of critical care, pediatrics, oncology, and infectious diseases.

KEY WORDS: Clinical Pharmacy Recommendations, Physicians Acceptance, Predictors

INTRODUCTION

Clinical Pharmacy is an emerging area of practice internationally and in the Middle East region^{1, 2}. Despite the fact that most governmental hospitals in the United Arab Emirates (UAE) hired different sizes of clinical pharmacy teams, data on outcomes of clinical pharmacy services in this country is lacking. In addition, the available international articles are largely descriptive in nature. Moreover, only few studies attempted to evaluate the effect of clinical pharmacist education and experience, specialty, type of recommendation, and class of medicine on the

clinicians' acceptance of the recommendations made³. In this study, we report the outcomes of clinical pharmacy recommendations in a tertiary care military hospital in the emirate of Abu Dhabi. We also investigate the significance of different educational, experiential, specialty, and medicinal factors in determining the outcomes of these clinical pharmacy recommendations.

METHODS

We built our clinical pharmacy recommendations database in May of 2010 using a Microsoft Office

Excel 2003 file kept on one computer in the clinical pharmacy section. Both the file and the computer were password protected. In this database, each clinical pharmacist documented their recommendations, starting from June 2010, in their assigned areas and specialties. Clinical pharmacy team supervisor assigned clinical pharmacists to areas and specialties on a rotational basis. Information documented included, clinical pharmacist identification number, patient demographic data, ward and/or specialty of recommendation, medication and its American Hospital Formulary System (AHFS) Classification⁴, type, rationale, and outcome of the recommendation in terms of being accepted or not. In this study we include all recommendations made in the year 2011. We chose 2011 for three reasons. First, our team was maximally contributing to the clinical services in 2011 whereas in 2012 our team was helping out in distributive services including the intravenous admixtures service which our team started in the hospital. Second, we had the hospital statistics available from 2011 at the time we planned to do this study. Finally, it enabled us to follow up on recommendations for up to two years post index admission and recommendation dates when we evaluated a random sample from the data. We retrospectively reviewed the Excel file to analyze the recommendations. We also randomly selected a sample of 47 patient files and evaluated them for the concordance with the Excel file as well as to estimate mortality, length of stay and number of readmissions. We collected these end outcomes because we aimed to compare them with the statistics for our hospital from 2011. This comparison may give us an idea about the sample. For example, if the statistics are similar to those of the hospital in 2011 it may mean that our sample is representative. Whereas if it is different, it may hint that future studies would need to look at such outcomes and to control for them. We conducted this research in accordance with the declaration of Helsinki of 1964 (last revised in 2013) and all information provided is anonymous.

Institution. Our institution is a tertiary care military hospital of about 350 beds. It serves a population of military and their families of about 300,000. In 2011, we had a total number of admissions of 7,699 patients. Average daily bed occupancy in 2011 was 42.5%. Our hospital has a wide range of specialties including critical care, pediatrics, oncology, internal medicine, cardiology, neurology, psychiatry, endocrinology, gastroenterology, pulmonology, infectious diseases, geriatrics, nephrology, dentistry, and surgery. System of documentation is largely paper-based. All the specialties are located in one

building except psychiatry which is located in another building within the camp.

Team. Our team consisted of 9 members; 7 clinical pharmacists and 2 pharmacists with clinical responsibilities. Two of the 9 had doctor of pharmacy (Pharm.D.) degrees. Five had board certifications from the board of pharmaceutical specialties in the United States of America. Three had post-bachelor degrees in Pharmacy. Two had an overall pharmacy practice experience of less than 7 years. And two had recognized clinical pharmacy experience of more than 3 years. Members of the team had administrative, research, educational as well as other practice, including conventional distributive, activities.

Outcomes. Broadly, we classified outcomes of recommendations into accepted and unaccepted. We reviewed a random sample of patient files to ensure concordance with the Excel database. We considered a priori concordance rate of more than 70% between documented recommendations in the Excel and patient files as acceptable. We also extracted data on mortality, length of stay in the index admission, and number of readmissions for this sample.

Statistical analysis. We used univariate analyses to compare the different variables among the subgroups of the outcomes of recommendations. We used the chi square and student t-tests for categorical and continuous data, respectively. When normality test failed, we used non-parametric tests. A P-value of less than 0.05 was considered statistically significant. We also attempted a multivariate logistic regression and artificial neural network analyses.

RESULTS

We had a total of 8,451 recommendations per 2330 patients (3.63 recommendations per patient) documented in the Excel file from beginning of June 2010 till end of March 2013. In 2011, we had a total number of recommendations of 3,871 (45.8%) made in 1323 patients (2.93 recommendations per patient). Only 1982 (51.2%) recommendations in 619 patients (3.2 recommendations per patient) had the clinical pharmacist identification number documented, and therefore, available for analyses. Greatest number of recommendations (N = 702, 31%) (Figure 1) made was in the medical wards which include all the internal medicine specialties except for cardiology. Lowest number of recommendations was in cardiology (N = 200, 9%). Note that the denominator in the previous two percentages is 2207 since some recommendations are counted twice. For example, pediatric surgery is counted both in pediatrics and in

surgery. Adding a medicine to the patient regimen accounted for the largest number of recommendation type (559, 28%) (Figure 2). Stopping a medicine ranked second (481, 24%). Antiinfective was the medication class with the largest number of recommendations (N = 447). Figure 3 summarizes the top 10 classes of medicine involved in the recommendation.

Considering qualifications and experience (figure 4), all the factors tested had a statistically significant ($P < 0.05$) effect (increased acceptance) except for the overall years of experience. Clinical Pharmacy experience of more than 3 years comprised 33% of interventions versus 21% for unaccepted recommendations ($P < 0.0001$). In addition, 46% of interventions were made by board certified team members versus 37% of unaccepted recommendations ($P = 0.002$). Clinical pharmacists made 75% of interventions versus 62% among unaccepted recommendations ($P < 0.0001$). Holders of Doctor of Pharmacy (Pharm.D.) degree were more among interventions (33%) than unaccepted recommendations (21%, $P < 0.0001$). Finally, there were more post-bachelor educated members among interventions (42%) versus unaccepted recommendations (32%, $P = 0.001$).

Critical care, oncology, and pediatrics (figure 5) were the three specialties associated with a statistically significant increased rate of acceptance for recommendations; 21% vs. 14% for critical care ($P = 0.002$), 12% vs. 7% for pediatrics ($P = 0.009$), and 19% vs. 6% for oncology ($P < 0.0001$). Internal Medicine was associated with a higher rate of rejected recommendations (44% vs. 34%, $P = 0.0002$). In regards to the type of recommendations (figure 6), stopping a medication was associated with more interventions (25% vs. 19%, $P = 0.0206$). Whereas adding a medication was associated with more rejections of recommendations (36% vs. 26%, $P = 0.0001$). As far as the class of medication is concerned, antiinfectives were associated with more interventions (26% vs. 18%, $P = 0.002$) (figure 7) whereas antilipidemic agents were associated with more rejections (6% vs. 2%, $P = 0.0003$).

In our random sample of patient files we observed a mortality rate of 4 out of 47 patients (8.5%) over a follow-up period of 2 years. In contrast, mortality at our hospital was 110 per 7,699 admissions (1.4%) in 2011. Length of Stay for patients ranged from 1 to 114 days (Median 7 days, Mean \pm Standard Deviation = 13 days \pm 16.2 days). In our sample of 47 patients, 10 and 3 patients were admitted once or twice, respectively, during a 2 year period following

the index admission. We were able to confirm that 77 out of 93 recommendations made in this sample (82.8%) were documented both in the Excel and patient files. Furthermore, 55 out of 74 available for evaluation (77%) had concordant outcomes in these files.

DISCUSSION

Our study demonstrates a clear association between education, experience, specialty, medication and type of recommendation and the outcome of such recommendations (i.e. physician's acceptance rate). To our best knowledge, no previous study has reported such correlations in a comprehensive fashion. For example Mogensen et al reported in a Danish study that medical physicians were more likely to follow on and accept pharmacy recommendations than surgical colleagues in an emergency department setting⁵. However, no correlations were made in this study between the medication class or clinical pharmacist education and experience and the outcome. Our study confirms that some medical specialties are more likely to accept clinical pharmacy recommendations but this finding may vary with subspecialty and setting. For example, although this observation is seen in oncology, infectious diseases, and pediatrics in our study, other medical specialties seemed to be resistant, similar to surgery, to recommendations made by clinical pharmacy. In contrast, other studies had conflicting results. For example, one USA⁶ and one UK⁷ studies showed no difference in physician's acceptance rates between medical and surgical specialties. These two studies were published in the 80s and 90s of the previous century, respectively, which may mean that there is a change in physician's acceptance of pharmacy new roles in medical versus surgical specialties. However, we still believe that clinical pharmacists must be cautious in interpreting results from these and similar studies in terms of the responsiveness of the different specialties to clinical pharmacists recommendations.

Bourne and colleagues³ showed that clinical pharmacist with critical-care training make important recommendations across general and specialized critical-care units and that the different units had different reasons, types, and drug classifications of the medication recommendations. Similarly, critical care areas were a major area in our study where clinical pharmacy recommendations were significantly more likely to be accepted. Moreover, extending on Bourne et al findings, we have shown that the class of medication is a significant predictor of acceptance by physicians. For example, while

antiinfectives were a class of medication for which physicians were more likely to accept clinical pharmacy recommendations, antihypertensives and antilipidemic were two classes where clinical pharmacy recommendations were less likely to be accepted.

Our study has also shown that the type of recommendation is an important predictor of acceptance. Similar to Al-azzam et al², our study confirmed that most common recommendation types were to discontinue, to add, or to change pharmacotherapy. Our study elaborated on these findings, however, that physicians were more likely to accept stopping a medication than to add a new medication to the patient regimen. We further observed that the likelihood of making a specific type of recommendation vary with the specialty although acceptance rates may prove ultimately to be similar across different specialties. For example, clinical pharmacists were more likely to recommend dose modifications to pediatricians than to other specialties (35% vs 25%, $P=0.0026$). Surprisingly, however, dose recommendations were not necessarily more likely to be accepted in pediatrics compared to other specialties. Another matching finding in this study compared to Al-azzam and colleagues² is the approximately similar rates of recommendations per patients (3.63 vs. 3.56 per patient). It is interesting to note that this rate is almost the same in a study from a neighboring region as well⁸.

We have also looked at the clinical pharmacist educational and experience backgrounds and its effect on physician's acceptance of the recommendations made. We found that the doctor of pharmacy degree, post-bachelor degrees in clinical pharmacy, clinical pharmacy experience of more than 3 years, and board certification were significant predictors of a higher acceptance rate. Overall years of experience, which include the years spent in conventional dispensing roles, failed to correlate with a higher physician's acceptance rate. It is unclear from our study, however, the relative importance of these variables and others in predicting the outcomes of clinical pharmacy recommendations. Although we attempted to study this relation in a multivariate regression model and an artificial neural network, both models did not converge to optimal solutions. We believe that this could be due to the fact that we have used probabilistic models. These models converged to solutions that would always predict that recommendations would be accepted. This in turn is thought to be due to the high acceptance rates in this study. Future studies may attempt at building such models in an optimal way to better evaluate the

relative importance of the different variables. For example, we can look into the best combination of experience and educational parameters to produce effective clinical pharmacists in a given setting.

Our study major limitation is the fact that it was conducted in one military medical institution in the United Arab Emirates which, although it offers services in the various specialties, may not reflect the practice in other institutions. Therefore, we call on researchers in clinical pharmacy to use this study as a guide and to investigate whether its findings can be reproduced in other countries or practice settings. We also did not report the significance, impact on quality of healthcare, and cost of the recommendations made which has been described in previous research⁸⁻¹¹. However, we believe that such outcomes are largely subjective and difficult to measure and should probably be addressed separately and in specific studies that look at individual medicines or group of medicines in well controlled settings and disease states.

Finally, it is noticeable that the concordance rates between the excel database of recommendations and the patient files exceeded the a priori set value of 70%. This finding makes us believe that the results of our study are robust. Considering the average occupancy of 42.5% in our hospital in 2011. If we calculate the approximate number of days for each patient spent in the hospital, we will observe that overall number of days spent in the hospital by all patients would be around $(0.425 \times 350 \times 365.25)$ which is 54,331 days. If we divide this value by total number of admissions we would get 7.1 days which is comparable to our median of 7 days in the random sample. However, although our study did not look at the end outcomes of clinical pharmacy recommendations such as mortality, length of stay, hospitalizations, or readmissions, it seems that such comparisons would be very difficult to undertake and clinical pharmacy may be erroneously linked to worse outcomes such as, for example, higher mortality. In fact a possible explanation for the seemingly high mortality in our sample would be that our clinical pharmacy team was targeting the more challenging and severe cases in consultations and recommendations. Moreover, mortality was normalized to admissions in the overall 2011 data whereas our sample mortality was normalized to the number of patients. Some patients may be admitted more than once in a given year. In final analysis, it is inevitable we believe that future research should focus, in a controlled manner, on demonstrating the real value of clinical pharmacy services on ultimate

outcomes as opposed to surrogate endpoints such as physician’s acceptance rates.

are mainly critical care, pediatrics, oncology, and infectious diseases.

CONCLUSIONS

Physician’s acceptance of clinical pharmacy recommendations is governed by different factors related to the physicians and clinical pharmacists themselves, their education, experience, specialty, as well as the medication, and the recommendation made. Clinical pharmacy leaderships should focus on the areas and specialties most responsive to practitioners input in patient care. These specialties

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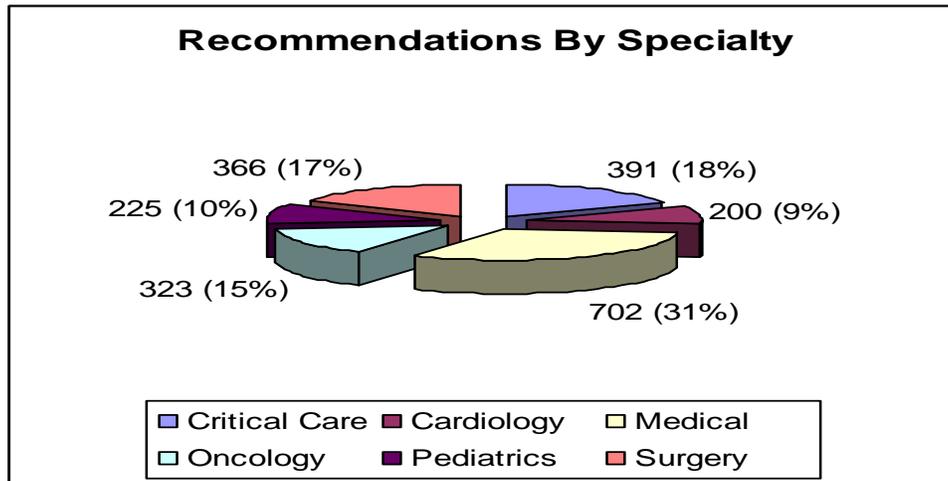


Figure 1. Number (Percentages from total number) of recommendations made by specialty.

Please note in this figure (figure above) the total number of recommendations does not add to 1982 because some recommendations are counted twice (i.e. under two different specialties. For example, Pediatric surgery intervention are counted under both pediatrics and surgery)

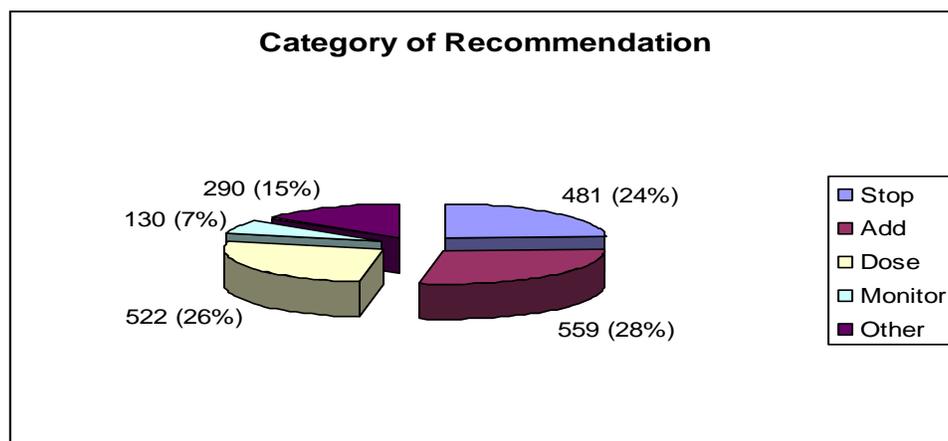


Figure 2. Number (percentage from total number) of recommendations by category or type of recommendation

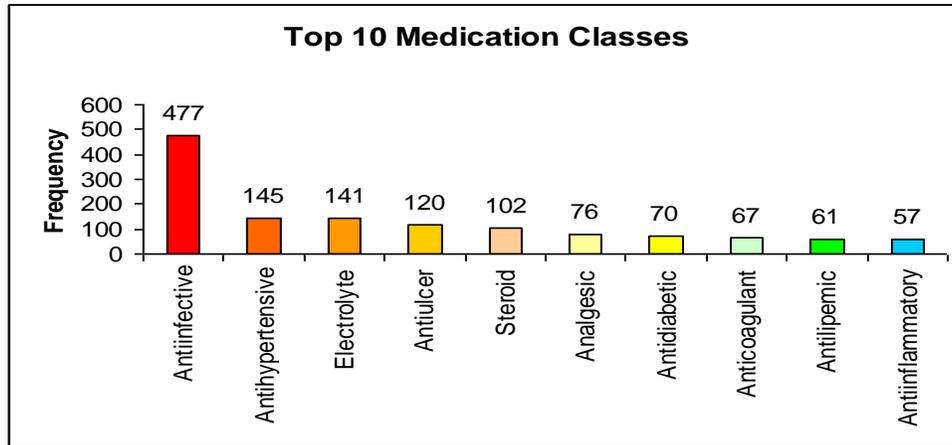


Figure 3. Frequency of recommendations by AHFS classification of medicines

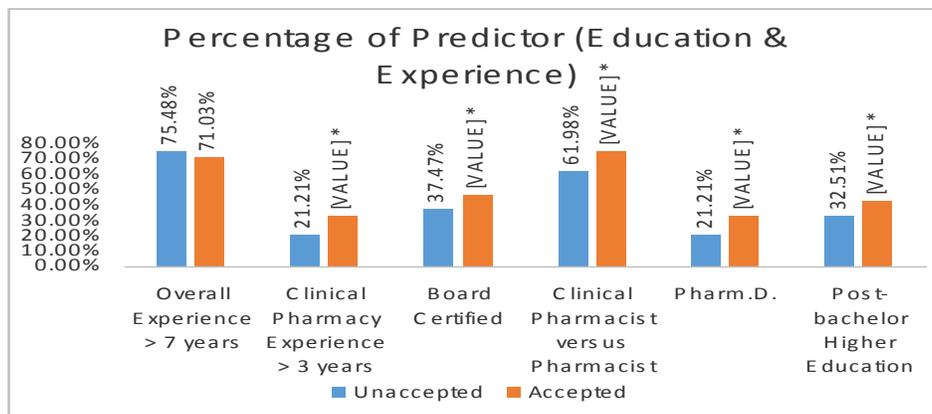


Figure 4. Percentages of unaccepted (blue) and accepted (orange) recommendations by different education- and experience-related variables. Variables with asterisk have significant (P-value < 0.05) differences in acceptance percentage. For example, clinical pharmacy experience of more than 3 years is significantly more likely to result in more acceptance of recommendations when compared with clinical pharmacy experience of less than 3 years.

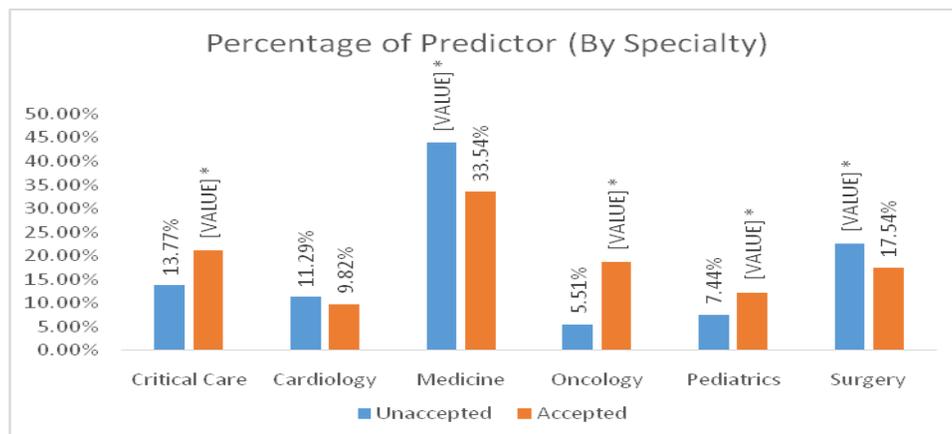


Figure 5. Percentages of unaccepted (blue) and accepted (orange) recommendations by different specialties. Variables with asterisk have significant (P-value < 0.05) differences in acceptance percentage. For example, oncology is a specialty where acceptance rates are significantly higher when compared to the other specialties.

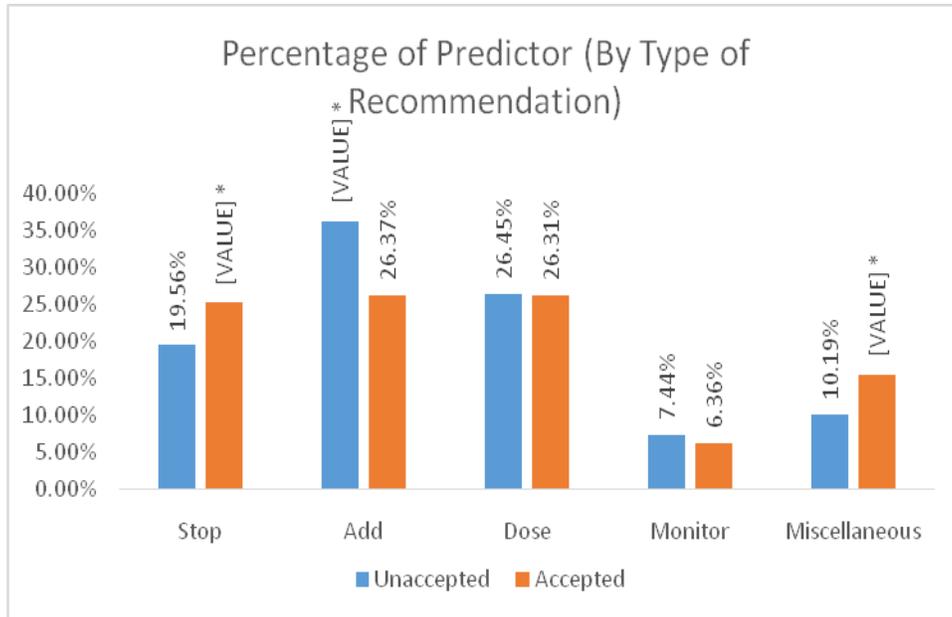


Figure 6. Percentages of unaccepted (blue) and accepted (orange) recommendations by type or category of recommendation. Variables with asterisk have significant (P-value < 0.05) differences in acceptance percentage. For example, stopping a medication is more likely to be accepted when compared to other types of recommendations.

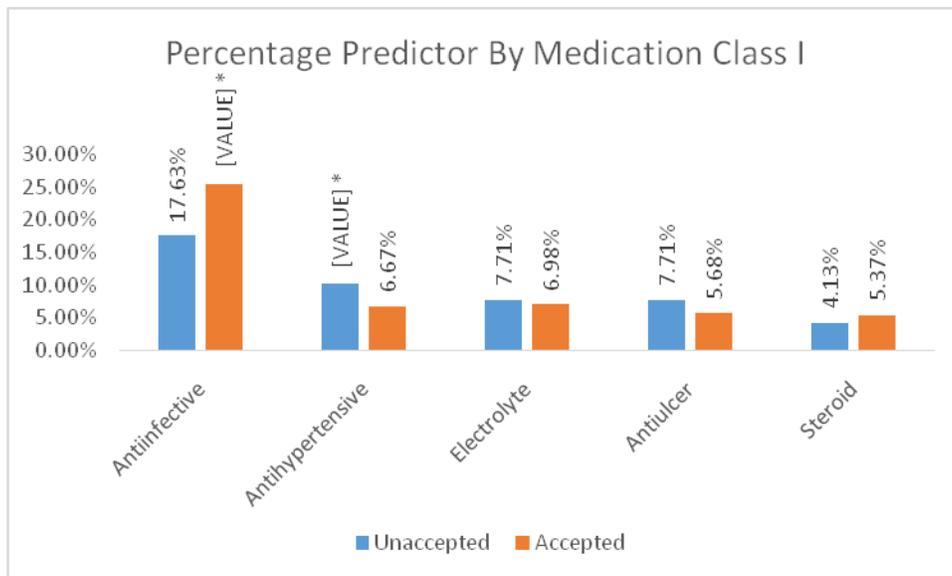


Figure 7. Percentages of unaccepted (blue) and accepted (orange) recommendations by different AHFS classes. Variables with asterisk have significant (P-value < 0.05) differences in acceptance percentage. For example, recommendations on antiinfective medications are more likely to be accepted compared to other classes.

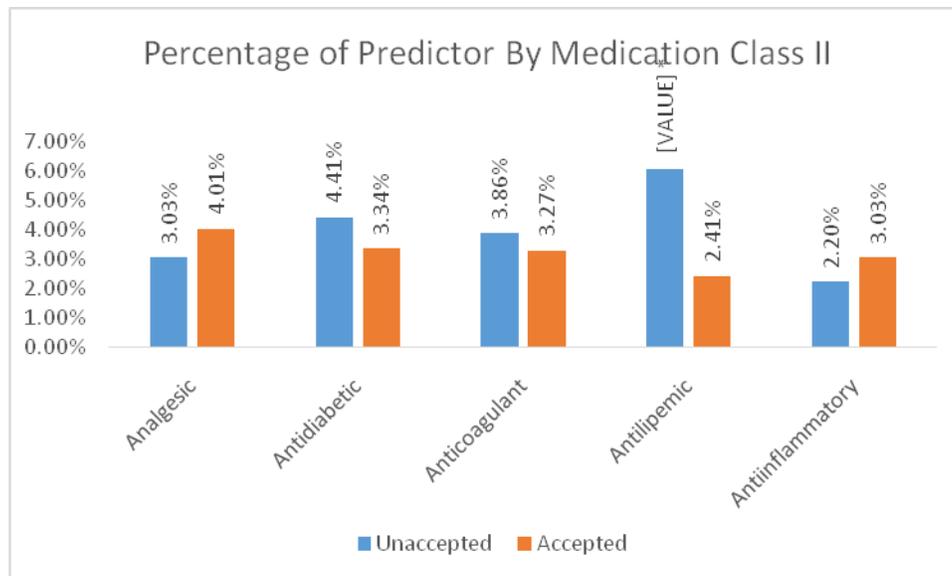


Figure 8. Percentages of unaccepted (blue) and accepted (orange) recommendations by different AHFS classes. Variables with asterisk have significant (P-value < 0.05) differences in acceptance percentage. For example, recommendations regarding antilipidemic agents are less likely to be accepted compared to other classes.

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