

Optimizing cardiac patient's safety: Assessing QT interval-prolonging drug alert in electronic prescription in hospitalized patients

Optimización de la seguridad del paciente cardíaco: Evaluación de la alerta de fármacos que prolonga el intervalo QT en prescripciones electrónicas en pacientes hospitalizados.

VILLAMAÑÁN E.¹, CARPIO C.³, COLLADA V.¹, SOBRINO C.¹, GOLOVKINA M.², RUANO M.¹, ARMADA E.⁴, HERRERO A.¹

1. Pharmacy Department. Hospital Universitario La Paz. IdiPAZ. Madrid, Spain

2. University of Wisconsin-Madison School of Pharmacy. Madison, United States

3. Pulmonology Department. Hospital Universitario La Paz. IdiPAZ. Madrid, Spain

4. Cardiology Department. Hospital Universitario La Paz. IdiPAZ. Madrid, Spain

Fecha de recepción: 26/10/2025 Fecha de aceptación: 12/12/2025

DOI: <http://dx.doi.org/10.4321/S1699-714X2026000200003>

ABSTRACT

Introduction: Prolongation of the QT interval is associated with severe ventricular arrhythmias and sudden cardiac death. Electronic prescribing systems may reduce inappropriate prescriptions of QT interval-prolonging drugs (QTIPD) by generating alerts during order entry.

Aim: The aim of this study was to evaluate prescribers' awareness, opinions, and preferences regarding an electronic health record alert system for QTIPD.

Materials and Methods: A six-item questionnaire was distributed to attending physicians and medical residents from a tertiary hospital who regularly prescribe using the electronic health record. The questionnaire assessed awareness of the alert system, its use in clinical decision-making, and perceived usefulness. In addition, changes in the number of QTIPD prescriptions before and after alert implementation were analyzed.

Results: A total of 101 questionnaires were completed by 50 attending physicians and 51 residents from 20 different medical and surgical specialties. Most prescribers (84%) were aware of the alert system, and 78% reported that it prompted them to evaluate patients' risk for QT interval prolongation. The alert was considered very useful by 61% of respondents and moderately useful by 37%. Furthermore, 86% of prescribers indicated they would like the system to suggest alternative non-QT-prolonging drugs.

A significant reduction in QTIPD prescriptions was observed after alert implementation, comparing the pre-alert period (before 2022) with the post-alert period (after 2023) (median 1,505 versus 1,335 prescriptions; $p = 0.027$). Haloperidol and clomipramine were the drugs with the greatest reduction in prescriptions.

Conclusion: Prescribers are generally familiar with and value QT alert systems, which support safer prescribing, particularly for neuroleptics and antidepressants, and contribute to improved patient safety overall.

Keywords: QT interval, long QT syndrome, alert system, electronic prescribing

INTRODUCTION

The QT interval on an electrocardiogram represents the duration of the action potential of ventricular myocytes. The prolongation of this repolarization phase of the action potential is known as long QT syndrome (LQTS). Prolongation of the QT interval is associated with ventricular tachycardia (specifically Torsade de Pointes or TdP), syncope, and sudden death.^{1,2,3,4}

In fact, sudden death is one of the most frequent causes of death in developed countries and represents 50% of all cardiovascular deaths and 20% of all-cause mortality.^{5, 6, 7, 8}

According to data from the Spanish Society of Cardiology (Sociedad Española de Cardiología), 40,000 people die annually in Spain due to sudden death, about one person every 20 seconds. The majority of these deaths are due to coronary disease, however, some are associated with arrhythmias due to QT interval prolongation.^{5,6,9} LQTS can be congenital, due to the presence of genetic mutations in the genes that code for sodium and potassium channel proteins, or it can be acquired, which is most frequently caused by medications that prolong the QT interval.^{1,2}

The relationship between pharmacologic treatment and QT interval prolongation has been established for some time, with many medications being associated with this risk.^{8,10,11,12} These medications include antiarrhythmics (amiodarone, sotalol), antibiotics (azithromycin, ciprofloxacin), antidepressants (amitriptyline, fluoxetine), and many others.^{9,13,14}

In recent years, this potential adverse effect has been the reason for withdrawal from drug markets; in fact, this is currently the second reason for withdrawal after hepatotoxicity.^{10,15}

Exposure to these medications and the incidence of LQTS is more likely in patients who are genetically susceptible. Additional risk factors include advanced age, female sex, low ventricular ejection fraction, left ventricular hypertrophy, ischemia, low heart rate, and electrolyte imbalances like hypokalemia, hypocalcemia, and hypomagnesemia.^{5,10,16}

When medical doctors and other prescribers initiate antiarrhythmic treatment in their typical clinical practice, they are aware of the QT interval prolongation risk, the possibility of TdP, and the fact that the risk is higher upon treatment initiation.¹⁷

However, they are not as aware of these consequences when prescribing medications used for other non-cardiovascular conditions. Certain non-cardio-

vascular medications can alter the QT interval due to direct action on potassium currents or by pharmacokinetic or pharmacodynamics interactions. This is not always taken into account as these medications are often not utilized by prescribers on a daily basis.¹⁶ Regardless, before prescribing a medication that can prolong the QT interval, it is necessary to evaluate the benefits and risks and the possibility of using an alternative agent. The implementation of an alert system in the electronic health record can help notify prescribers of lesser-known QT interval-prolonging drugs (QTIPD) and aid them in their clinical decision-making.¹⁰

In fact, many hospitals already have alert systems in place to help promote medication safety.

This study aims to analyze such an alert system for QT interval-prolonging medications by evaluating prescriber preferences and their perceived utility of the alerts. The primary outcome of the study was to evaluate the utility of the alert system and secondary outcome was to determine the changes in the prescriptions of these drugs over the year before and after the implementation of the QT alert in the electronic prescription.

MATERIALS AND METHODS

This was a prospective study of the perspectives and opinions of prescribers regarding an alert system for QT interval-prolonging medications. Pharmacists and cardiologists at La Paz University Hospital, a 1,350 bed tertiary hospital, developed the study protocol. This tertiary hospital uses an electronic prescription record to prescribe medications and 5,500 to 6,000 medications are prescribed daily, approximately 3% of which are QT interval-prolonging agents. The pharmacy department has recently developed an alert system in the prescription record that places a heart-shaped symbol next the medications that can prolong the QT interval, prompting prescribers to consider this adverse effect.

In order to evaluate the utility of this alert system, hospital pharmacists developed a six-item questionnaire to assess prescribing habits and the opinions of prescribers. The questions were designed to evaluate whether the prescribers were aware of the alert system, if they use it when making prescribing decisions, and if they think that the tool is useful in promoting patient safety.

The questionnaire was distributed to attending physicians and medical residents across various units in the hospital to gather opinions from a variety of

specialties. Pharmacy staff distributed and collected questionnaires upon completion. After all questionnaires were collected, a data analysis was conducted.

QTIPD prescriptions over a year before and a year after the QT alert was implemented was evaluated using the drugs prescription registry collected in the electronic prescription program.

ETHICS APPROVAL

This study did not involve patient-level identifiable data. It evaluated prescriber perceptions through a voluntary anonymous survey and analysis of aggregated prescription data. Approved by Hospital La Paz Ethics Committee, Ref intern code: 2023.013 y codeHULP: PI-5532)

RESULTS

One hundred and one questionnaires were collected from 50 attending physicians and 51 medical residents. Various specialties were represented (figure 1), including internal medicine, cardiology, intensive care, geriatrics, and many others. A total of 20 specialties were included in the study. Medical specialties made up 77.2% of the responders and the remaining 22.8% were surgical specialties. Figure 1 also depicts the number of attending physicians and medical residents that completed the questionnaire.

A total of 101 responses were collected: 23 from prescribers from surgical specialties and 78 from medical specialties. The first part of the questionnaire asked prescribers if they were already aware of the QT alert system. The vast majority of prescribers (84.2%) were already aware of the alert system and were using it to guide their prescribing decisions (table 1).

The second part of the questionnaire prompted

prescribers to evaluate whether they took these alerts into account when prescribing and whether the alerts influenced what medications they prescribe. Thirty-eight percent of prescribers noted that they considered the alerts and used them to determine which medications to prescribe, while an additional 39.6% considered the alerts, but did not necessarily use them in decision-making. Of note, a greater proportion of prescribers from medical specialties reported that the alert influenced their prescribing decisions compared to prescribers from surgical specialties (39.7% vs 30.4%).

The next item on the questionnaire asked whether the alert system prompted prescribers to evaluate whether their patients were at risk for QT interval prolongation. Seventy-eight percent of prescribers reported that the alerts prompted them to perform this assessment.

The following item was designed to assess future quality improvement initiatives by asking prescribers if they would like the alert system to be updated to suggest alternative non-QT prolonging agents. A large portion of prescribers (86.1%) reported that they would like to have alternative agents suggested. Prescribers from medical specialties were much more likely to say that they did not want the alert to suggest alternatives compared to prescribers from medical specialties (16.7% vs 4.3%).

The next item prompted prescribers to assess whether they were aware of the potential QT interval-prolonging side effects of the medications that they prescribe. Most prescribers were aware of the QT-prolonging effects of medications they regularly prescribe, but found the tool useful for medications they do not regularly prescribe (57.4%). When con-

Figure 1. Distribution of the different medical specialties of the questionnaire respondents.

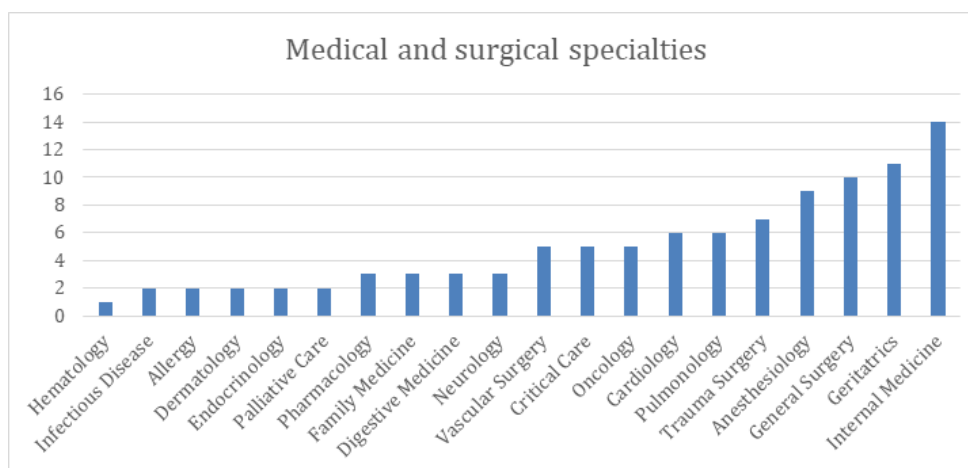


Table 1. Prescriber responses to the six-item questionnaire regarding the QT interval alert system. The table lists the total number of responses, as well as the number of responses from prescribers from surgical and medical specialties.

Question/Response	Total Responses	Responses from Surgical Specialties	Responses from Medical Specialties
1. Were you aware of the QT alert system?			
Yes	85 (84.2%)	18 (78.3%)	67 (85.9%)
No	16 (15.8%)	5 (21.7%)	11 (14.1%)
2. Did you take the QT alert into account when prescribing and did it influence the medications you prescribed?			
I have considered the QT alert, and it influenced my prescribing decisions.	38 (37.6%)	7 (30.4%)	31 (39.7%)
I have considered the QT alert, but it did not influence my prescribing decisions.	40 (39.6%)	11 (47.8%)	29 (37.2%)
I have not considered the QT alert.	23 (22.8%)	5 (21.7%)	18 (23.1%)
3. Did the QT alert prompt you to evaluate whether your patients were at risk for QT interval prolongation?			
Yes	79 (78.2%)	19 (82.6%)	60 (76.9%)
No	22 (21.8%)	4 (17.4%)	18 (23.1%)
4. Do you think the QT alert system should suggest alternative non-QT prolonging agents?			
Yes	87 (86.1%)	22 (95.7%)	65 (83.3%)
No	14 (13.9%)	1 (4.3%)	13 (16.7%)
5. Were you aware of the potential QT interval-prolonging side effects of the medications when you prescribed them?			
Yes, in most cases.	17 (16.8%)	3 (13.0%)	14 (17.9%)
Yes, for the medications that I normally prescribe, but I consider alert for medications I am unfamiliar with.	58 (57.4%)	9 (39.1%)	49 (62.8%)
Not for most medications.	26 (25.7%)	11 (47.8%)	15 (19.2%)
6. Do you think the QT alert contributes to improving patient safety?			
I think it is very useful for patient safety.	62 (61.4%)	12 (52.2%)	50 (64.1%)
I think it is moderately useful for patient safety.	37 (36.6%)	11 (47.8%)	26 (33.3%)
I do not think it is very useful.	2 (2.0%)	0 (0%)	2 (2.6%)

Table 2. Differences in QT interval-prolonging drugs prescription in surgical specialities a year before and a year after the QT alarm implementation.

QT interval-prolonging drugs	N Prescriptions preQTalarm	N Prescriptions posQTalarm	Relative reduction (%)
Salbutamol	3995	2948	26,2
Amitriptilina	977	691	29,3
Clorpromazina	146	71	51,4
Clozapina	267	148	44,6
Diltiazem	1531	121	92,1
Domperidona	90	63	30
Escitalopram	1332	1108	16,8
Famotidina	1194	1006	15,7
Flecainida	271	233	14,02
Fluoxetina	576	373	35,24
Furosemida	15121	13083	13,5
Haloperidol	15370	1676	89,1
Indapamida	270	89	67,03
Ivabradina	609	418	31,36
Litio	179	74	58,65
Loperamida	807	745	7,7
Metoclopramida	5288	3955	25,2
Mirtazapina	3004	1988	33,8
Norepinefrina	41	2	95,1
Olanzapina	1545	1385	10,3
Ondansetron	3277	1643	49,9
Paliperidona	29	10	65,5
Pantoprazol	21319	15382	27,8
Paroxetina	903	511	43,4
Quetiapina	5494	4849	11,1
Risperidona	1098	546	50,3
Salmeterol	6	3	50
Sertralina	2791	2393	14,3
Terbutalina	16	6	62,5
Tiaprida	1424	1038	27,1
Tramadol	4139	2975	28,12
Trazodona	2891	1880	35
Venlafaxina	689	537	22,1
Clomipramina	1526	84	94,4

Table 3. Differences in QT interval-prolonging drugs prescription in medical specialities a year before and a year after the QT alarm implementation.

QT interval-prolonging drugs	N Prescriptions preQTalarm	N Prescriptions posQTalarm	Relative reduction (%)
Amitriptilina	2746	2551	7,1
Aripiprazol	3276	3117	4,8
Clorpromazina	411	374	9
Clofazimina	139	21	85
Clomipramina	830	414	50,1
Clotiapina	1175	1132	3,6
Domperidona	228	157	31,1
Escitalopram	5347	4763	10,9
Famotidina	4806	3852	19,8
Fluoxetina	1729	1707	1,2
Furosemida	83882	81096	3,3
Haloperidol	83662	11024	86,8
Hidroclorotiazida	6619	6510	1,6
Indapamida	1154	909	21,2
Ivabradina	2696	2318	14
Litio	2031	1721	15,3
Loperamida	3262	2915	10,6
Metoclopramida	9404	7260	22,8
Mianserina	107	48	55,1
Mirtazapina	13827	12313	10,9
Norfloxacino	489	191	60,9
Olanzapina	16100	15597	3,1
Omeprazol	63074	60843	3,5
Pantoprazol	49049	42030	14,3
Paroxetina	2511	2479	1,2
Propafenona	51	5	90,1
Quetiapina	37109	36049	2,8
Risperidona	7350	7148	2,7
Sertralina	14405	12857	10,5
Terbutalina	34	19	44,1
Venlafaxina	3094	2874	7,1

sidering the different specialties, surgical specialties were most likely to be unaware of potential QT interval-prolonging side effects (47.8%).

The final part of the questionnaire evaluated whether prescribers found the alert system to be useful in promoting patients safety. Overall, nearly all prescribers (98%) found the alert system to be very or moderately useful in promoting the safety of patients being treated with medications that prolong the QT interval. These results were consistent among providers from medical and surgical specialties.

Regarding the number of QTIPD prescriptions in our study, we observed that there was a reduction when comparing the year before 2022 (preQT alarm) and after 2023 (posQT alarm) the implementation of the alarm (745.199 over 2022 prescriptions vs 515.551 over 2023). Thus, median prescriptions over 2022 was 1.505 [interquartile range 38-6.581,5] and over 2023 it was 1.335 [36.5-7.405] ($p=0.027$).

This is despite the fact that the number of hospital admissions in the hospitalization wards included in the study the year before the alarm was incorporated was higher (25,490 admissions in 2022 vs 27,558 in 2023).

When the data were disaggregated by medical and surgical specialties, a greater reduction in QTIPD prescriptions was detected in surgical specialties (128.028 prescriptions preQT alarm vs 93.620 posQT alarm) than in medical specialties (489.141 preQT alarm vs 421.931 posQT alarm) This is also taking into account that the number of admissions to surgical specialties increased last year due to QT alarm (14.477 vs 16.254), while in medical specialties the number of admissions was similar (11.013 vs 11.558).

Regarding the QTIPD involved, in surgical specialties of 65 QTIPD potentially prescribable QTIPDs, 19 were not prescribed either before or after the implementation of the alert. A reduction in post-QT alarm prescriptions was observed in 35 QTIPD of the remaining 46 (35/65-19, 76.1%) while in medical specialties of 65 QTIPD potentially prescribable QTIPDs, 13 were not prescribed either before or after the implementation of the alert. A reduction in post-QT alarm prescriptions was observed in 31 QTIPD of the remaining 52 (31/65-13, 59.6%). Our results are shown in tables 2 and 3.

DISCUSSION

The results of this study suggest that the alert system for QT interval-prolonging medications is highly valued by prescribers. Most physicians surveyed

were aware of the alert system and found it useful for assessing the risk of QT prolongation in their patients, especially for medications they do not regularly prescribe. This alert system could be particularly useful for surgeons, as they acknowledged a higher likelihood of being unaware of the potential QT interval-prolonging side effects.^{18,19}

The majority of prescribers considered the alert system to be very or moderately useful for patient safety. This is in concordance with previous authors suggesting that electronic health records (EHRs)-based alert systems can improve clinical decision-making.^{20,21,22} Previous research supports the positive impact of alert systems in EHRs on clinical decision-making and reducing medication errors.^{20,21} However, it is crucial to balance the frequency and design of alerts to avoid alert fatigue, where clinicians may ignore or disable frequent alerts.^{20,21,22,23}

Prescribers reported a preference for the alert system to suggest alternative non-QT prolonging agents. Incorporating this feature could further facilitate clinical decision-making and enhance patient safety. Literature indicates that offering alternatives within alerts can increase adherence to safety recommendations and optimize pharmacological treatments. Interestingly, physicians from medical specialties were more likely to express that they did not want the alert to suggest alternatives compared to their surgical counterparts. This difference in opinion among specialties should be considered when enhancing the alert system.

One of the most notable findings is the reduction in the prescription of QT interval-prolonging medications following the implementation of the alert system. This decrease was more significant in surgical specialties compared to medical specialties, possibly due to increased awareness and education provided by the alert system, especially in areas where QT prolongation risk is not a daily consideration. Previous studies have shown that alert systems can improve patient safety by reducing medication-related adverse events.^{21,22}

However, while the study observed a reduction in the prescription of QT interval-prolonging drugs post-implementation of the alert system, attributing this reduction exclusively to the alert system is not straightforward. The study did not control for other potential factors influencing prescribing behaviors, such as changes in hospital policies, new clinical guidelines, or increased awareness about QT prolonga-

tion risks outside the alert system. Therefore, while the alert system likely contributed to the reduction, other concurrent interventions and external factors might also have played a role.

The analysis of different drugs involved in this side effect revealed that in surgical specialties, the reduction in prescriptions was particularly notable for haloperidol, risperidone, and clomipramine. These medications are commonly used in perioperative and postoperative care. The significant decrease in these specific drugs suggests that the alert system effectively raised awareness among surgeons about the QT prolongation risks associated with these medications. Diltiazem, a calcium channel blocker with a notable reduction in prescriptions post-implementation, is frequently used to manage hypertension and arrhythmias but is known to prolong the QT interval.

In medical specialties, there was a reduction in prescriptions of clomipramine and haloperidol. Clomipramine, a tricyclic antidepressant, and haloperidol, often used in psychiatric and geriatric settings, are both associated with a high risk of QT prolongation. The reduction in their use highlights the need for increased vigilance and a shift towards safer prescribing practices in these settings.

The results of our study suggest that there is a lack of knowledge about this potentially serious adverse effect of some drugs. This affects a large number of daily prescriptions in hospitals. Aiding the electronic prescription of these drugs by alerting doctors about this potential effect appear to be useful in the opinion of doctors and, based on the results, this alert appears to be especially useful in the safety of prescriptions of neuroleptic drugs to hospitalized patients, and antidepressants.

These findings are consistent with existing literature highlighting the benefits of clinical decision support systems (CDSS) in reducing adverse drug events (ADEs). Studies have shown that CDSS, particularly those integrated within EHRs, can significantly improve medication safety by providing real-time alerts and recommendations. However, the success of these systems depends on their ability to balance alert sensitivity and specificity to avoid alert fatigue among prescribers.

LIMITATIONS

This study has several limitations. The primary limitation is the nature of the questionnaire, which may not capture all opinions and behaviors of prescribers. Additionally, the study was conducted in a

single hospital, which may limit the generalizability of the results to other clinical settings. Future research should consider a multi-center approach and include objective measures of medication safety outcomes to validate these findings.

CONCLUSIONS

In conclusion, the implementation of an alert system for QT interval-prolonging medications in the electronic health record has been assessed by prescribers as a valuable tool for improving patient safety and guiding prescribing decisions. Most physicians find the system useful and suggest additional improvements to enhance its effectiveness. This study highlights the importance of clinical decision support systems in medical practice and their potential to reduce medication-related adverse events.

The results suggest that the alert system could be further improved by adding a feature that suggests alternative medications that do not prolong the QT interval. This addition could enhance the efficiency of prescribers and further improve patient safety by recommending safe alternatives for at-risk patients. Overall, this alert system has shown promising benefits in prescribing habits and helps prescribers and the entire health system optimizing cardiac patients safety. It could be specifically helpful for surgeons when prescribing neuroleptics or antidepressants. More prospective studies are needed to confirm these observations.

STATEMENTS AND DECLARATIONS

Potential Competing Interests:

The authors have no conflicts of interest to disclose.

Funding Support:

The research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

All authors have contributed intellectually to the the paper, gather the conditions of

authorship, and have approved the final version of the paper. On their behalf, I declare

that the paper is original and has not been previously published and is not under review by any other journal.

REFERENCES

1. Kass RS, Moss AJ, Long QT syndrome: novel insights into the mechanism of cardiac arrhythmias. *J Clin Invest.* 2003;112:810-5.
2. Priori SG, Schwartz PJ, Napolitano C, Bloise R, Ronchetti E, Grillo M, et al. Risk stratification in the long QT syndrome. *N Engl J Med.* 2003;348:1866-74.
3. Jayasinghe R, Kovoor P. Drugs and QT interval. *Australian Prescriber.* 2002;25:63-5.
4. Dessertenne F. La tachycardie ventriculaire a` deux froyers oppose´ s variables. *Arch Mal Coeur Vaiss.* 1966;59:263-72.
5. Myerburg RJ, Kessler KM, Castellanos A. Sudden cardiac death; epidemiology, transient risk, and intervention assessment. *Ann Intern Med.* 1993;119:1187-97.
6. Myerburg RJ, Interian A, Jr, Mitrani RM, Kessler KM, Castellanos A. Frequency of sudden cardiac death and profiles of risk. *Am J Cardiol.* 1997;80:10F-19F.
7. Gorgels AP, Gijsbers C, de Vreede-Swagemakers J, Lousberg A, Wellens HJ. Out-of-hospital cardiac arrest – the relevance of heart failure. The Maastricht Circulatory Arrest Registry. *Eur Heart J.* 2003;24:1204-9.
8. Asmundis C, Brugada P. Epidemiolog´ıa de la muerte su´ bita cardiaca. *Rev Esp Cardiol.* 2013;13:2-6. 2.
9. Zipes DP, Wellens HJJ. Sudden cardiac death. *Circulation.* 1998;98:2334-51.
10. Roden DM. Drug-induced prolongation of the QT interval. *N Engl J Med.* 2004;350:1013-22.
11. Van Noord C, Eijgelsheim M, Stricker BH. Drug- and non-drug-associated QT interval prolongation. *Br J Clin Pharmacol.* 2010;70:16-23.
12. De Ponti F, Poluzzi E, Cavalli A, Recanatini M, Montanaro N. Safety of nonantiarrhythmic drugs that prolong the QT interval or induce to sade de pointes: An overview. *Drug Saf.* 2002;25:263-86. 8.
13. Ayad RF, Assar MD, Simpson L, Garner JB, Schussler JM. Causes and management of drug-induced long QT syndrome. *Proc (Bayl Univ Med Cent).* 2010;23(3):250-255.
14. Isbister GK. Risk assessment of drug-induced QT prolongation. *Aust Prescr.* 2015 Feb;38(1):20-4.
15. Shah RR. Drug-induced QT interval prolongation: Does ethnicity of the thorough QT study population matter? *Br J Clin Pharmacol.* 2013;75:347-58.
16. Villamañán E, Armada E, Ruano M. Drug-induced QT interval prolongation: do we know the risks?. *Med Clin (Barc).* 2015 Mar 15;144(6):269-74.
17. Maisel WH, Kuntz KM, Reimold SC, Lee TH, Antman EM, Friedman PL, et al. Risk of initiating antiarrhythmic drug therapy for atrial fibrillation in patients admitted to a university hospital. *Ann Intern Med.* 1997;127(4):281-4.
18. Villamañán E, Larrubia Y, Ruano M, Moro M, Sierra A, Pérez E, et al. Health personnel assessment about medical order entry systems of pharmacologic treatments in hospitalized patients. *Rev Calid Asist.* 2013 Sep-Oct;28(5):313-20.
19. Ayad RF, Assar MD, Simpson L, Garner JB, Schussler JM. Causes and management of drug-induced long QT syndrome. *Proc (Bayl Univ Med Cent).* 2010 Jul;23(3):250-5.
20. Armada ER, Villamañán E, López-de-Sá E, Rosillo S, Rey-Blas JR, Testillano ML, et al. Computerized physician order entry in the cardiac intensive care unit: effects on prescription errors and workflow conditions. *J Crit Care.* 2014 Apr;29(2):188-93.
21. Ruano M, Villamañán E, Pérez E, Herrero A, Álvarez-Sala R. New technologies as a strategy to decrease medication errors: how do they affect adults and children differently? *World J Pediatr.* 2016 Feb;12(1):28-34.
22. Bates DW, Teich JM, Lee J, Seger D, Kuperman GJ, Ma'Luf N, et al. The impact of computerized physician order entry on medication error prevention. *J Am Med Inform Assoc.* 1999;6(4):313-21.
23. Weingart SN, Toth M, Sands DZ, Aronson MD, Davis RB, Phillips RS. Physicians' decisions to override computerized drug alerts in primary care. *Arch Intern Med.* 2003;163(21):2625-31.

Esta obra está bajo una licencia de Creative Commons Reconocimiento No Comercial Sin Obra Derivada 4.0 Internacional.

