

New ICT Technologies to Improve Clinical Outcome in Toxicology and Poisoning



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Introduction

We can see in many healthcare setting (but especially in business and industries fields) that technologies gives great solution in order to best manage patient's life or other relevant organizative problems. In example: Surgery robots, Drug therapy Prescribing systems informative programs RFIDD systems to recognize patients, Emergency drug hospital service systems, Dose unit systems, Oncologic lab robots, Biomedical database (interaction verify), Diagnostic instruments, Auto diagnostic systems, Imaging, Biomedical database for transplant biocompatibility, Healthcare dedicate software and so on.

All technologies that support the clinicians work adding specific capacity (in example recording high number of data or registering some physical properties other). As we have see to apply this kind of technology we can improve also clinical toxicological outcomes in example introducing a more rational management systems of antidotes stokes (and logistics) to provide to the emergency department the right molecule in the right time.

Clinicians without a specific diagnostic systems or right availability of antidotes cannot save patient life in High risk situations as poisoning and toxicological event [1]. Technologies that must be controlled and managed also by clinical and hospital pharmacist to obtain the right results and not only by informatics professionals.

Material and Methods

In this work we used an observational review method to find some relevant (in our opinion) literature to verify the advantages and benefit to deeply use ICT new technologies to

improve clinical outcomes in toxicological field. After this review phases we observe the results obtained in the literature find with the aim to have a new management tool to introduce in the many hospital situations.

We also analyze the results of a practical experience related to the introduce of an expert systems to manage emergency drug hospital cabinet to cover the need of a Provincial hospital (linked to other 4 hospital) during a period of 6 month (costs avoided and risk) with a prospective approach starting from July 2015 to February 2016 (and after 1 year).

Results

From literature we have find this works and practical experiences related to the scope of our review:

Murphy et al. writes that

Inadequate stocking of essential antidotes in hospitals is an internationally documented problem. A concrete and sustainable system-wide solution for easy access to antidotes in emergency departments was developed and implemented in Nova Scotia, Canada.

Antidote stocking guidelines and a system wide antidote management strategy were established. A standardized collection of antidotes housed in highly visible containers in provincial EDs was implemented for timely access. Antidote-specific online administration guidelines were developed. Using the poison centre for surveillance, the antidote program maintained a database of antidote utilization patterns; 11 years of data were available for analysis.

The Nova Scotia Antidote Program demonstrates that a solution to inadequate antidote stocking is achievable and requires a system-wide approach with ongoing maintenance and surveillance. The frequency and distribution of antidote usage documented in this program supports the need for enhancement of emergency preparedness. The poison centre and hospital pharmacies are crucial to surveillance and maintenance of this program [3].

Broto-Sumalla A et al. observed that

Antidotes may have a relevant role in acute intoxication management and the time until its administration can influence patient survival. Study conducted by a questionnaire sent in early 2015 to 70 hospitals in Catalonia providing emergency services. Qualitative availability on each antidote was considered adequate when present in at least 80% of hospitals. The quantitative availability was considered adequate when at least 80% of hospitals had the number of units of antidote recommended.

Lower complexity hospitals (level A) showed a percentage of adequate qualitative and quantitative availability of 66.7 and 42.9% respectively. In higher complexity hospitals (level B) qualitative and quantitative availability was adequate in 64.5 and 38.7% of the antidotes respectively. Data showed no differences between the different health regions as well as a positive correlation ($p < 0.05$) between the availability of antidotes in Catalonia hospitals is generally low and shows differences across health regions and depending on level of complexity [4].

According Nissen LM et al

A self-report survey was sent to 128 Queensland hospitals with acute care facilities. The stock level of the following antidotes was determined: acetylcysteine, anti-digoxin Fab antibodies (digibind), atropine, calcium gluconate, cyanokit, desferrioxamine, flumazenil, glucagon, intravenous ethanol, methylene blue, naloxone, pralidoxime and pyridoxine. Other factors sampled were bed capacity, rural, remote and metropolitan areas classification, use of formal stock reviews by pharmacists or nurses, existence of formal borrowing agreements with other facilities for non-stocked antidotes, distance to the nearest referral hospital and time taken to transfer antidotes from another hospital.

Pharmacists or nurses responsible for maintaining antidote stocks in Queensland hospitals. Proportions of hospitals with sufficient antidote stock to treat a 70-kg adult for four or more hours using previously published guidelines. Survey response rate was 73.4%. No hospital had sufficient stock of all 13 antidotes. The proportion of hospitals with sufficient stocks varied from 0% (pyridoxine) to 68.1% (acetylcysteine). Larger hospitals had a higher frequency of sufficient antidote stocks. Only 16% of hospitals claimed to be able to acquire an antidote from another facility within 30min.

Most Queensland hospitals stocked some important antidotes, but few had sufficient stock to treat a 70kg patient or acquire an antidote within the recommended time frame of 30min. Specific antidote stocking guidelines might be required for Queensland hospitals. A formalized program for stock rotation with rural facilities should be explored [20].

Richard CD also writes that

Insufficient stocking of antidotes needed on an emergency basis has been documented repeatedly in the United States and other countries. However, it is difficult for hospitals to address this situation because widely accepted guidelines for antidote stocking have not emerged, although certain regional guidelines have been promulgated. 10, 23 National guidelines are difficult to produce because of the heterogeneity of hospital organization and management, as well as the diversity of service area. The expert panel therefore concluded that a mechanism allowing customization of stocking for each hospital should be used." And "Other solutions are to contact the regional poison center, which often knows where antidotes are stocked in their service area. Collaboration with other health care facilities can be successful, although the breakdown of informal antidote transfer agreements can cause patient harm [21].

According Luisetto et al

The introduction of expert systems, the application of a novel computerized pharmacy-cabinet system for some Hospital can completely overtake and replaced the service by active pharmacist guardian system. A reduction of about 75,000 euro, which is the average cost in an Italian hospital, per 5 years in cost, covered by 4-6 postgraduate hospital pharmacists (initially there are the costs for software and other technology: about 5000 euro). The new system covers the 99% of the emergency needs and only 1% needs safeguard system activation [14]. According to these results, we firmly and confidently believe that such system not only can or must be taken as a successful model, for some kind of hospitals, but it may find advantages and applications in many other similar situations. We think that psychological and behavior skills in team working give a rapid collaboration in the emergency stoke equip. And a discipline named Clinical pharmaceutical care [8] can be a useful instrument that adds the ICU and management tools to the classic clinical pharmacist competencies also in management of drugs emergency stokes. The use instruments as dedicated software, automatized drugs stokes systems, dose unit systems, informatics prescription and other ICT tools make a more safe systems and reduce risk. The safeguard systems cover the 1% of cases out of these systems" [14].

And according velocity management strategy: "Starting from observation of some relevant bibliography in healthcare world we can see that using new technologies added to professional social media and sharing economy principle we can obtain rapidly reduction about 30% of global costs. In example in ICU

ward and toxicology field in which saving life can give relevant reduction in global costs. The same this kind of results can be obtained also in many other management fields (economy, financial, industry, communications, university, research and other) [10]. Related to clinical outcomes and clinical pharmacist activity in medical team: we can see in example

1. Bond CA et al demostred that, in 2007 clinical pharmacy service, pharmacy staffing, and hospital mortality rates. In seven hospitals, clinical pharmacy service reduces mortality rates in a significant way [7].
2. Chisholm et al, in 2010 published in "Pharmacist's effect as team members on patient care: systematic review and meta-analyses": pharmacists provided direct patient care has favorable effects across various patient outcomes, health care settings, and disease states. (Significant p 0.005)"[8].
3. Luisetto et al verify that: the permanent presence of clinical pharmacist in many medical teams improves clinical outcomes (also in toxicology field) [10].
4. In editorial Main Focal Of Clinical Pharmacist 2017 is writes that "We think that the main focus of the clinical pharmacist must be applied in priority way to the most critical patients in order to achieve the best results available [12]. In this condition even benefit of 1 life achieved in mortality rate is a real golden endpoint (we can think for example to a pediatric poisoning, or severe infectious disease in pregnancy or the effect of inefficacy immunosuppressive therapy in transplanted et other) [12]. This can be considered in example as a reduction in NNT to improve a therapeutic strategy" focus [11] we can observe also other practical experiences useful in this analysis are Ferrara Regional Antidote Center (Italy) and related web site with a system of HUB and SPOKE to link other regional hospital and to provide the more rare antidotes. This experience show the crucial role that a REGIONAL pharmacy CENTRE in the global process in collaboration with National institution and other Poison Centre (Maugeri-Cav Pavia) and local situation.
5. This model is an innovative model in the national health care system that imply a strictly collaboration with anti-poison official centre, and central- Local institution [13].
6. This centre provides currently antidotes information system and high level formative provider to cover the Updating need of toxicological medical team.
7. Emergency drug hospital cabinet systems practical experience-Piacenza (SIFO society of Italian hospital pharmacist POSTER ABSTRATC) 2016 Milan (this poster has win the best presentation award in young pharmacist section) [14].

In this last two example the ICT tool can make possible to have the situation of the emergency drug and antidotes stokes (quail-quantitative) in every SPOKE and rapid information about rare antidotes position in order to achieve they in rapid way (2-6 hours) (in the first experience) or to have availability of other emergency drugs h24 also with central pharmacy closed (second experience) in a safety way and containing costs. This experience [14] are linked with a correct management of the systems with a really rational way and recognized officially by SIFO society of hospital pharmacist (Italy).

In this practical experience [14] no near miss event or other patient risk or even fatal event was observed. During 6 month and was covered the emergency need of drugs in the 99% of cases, and only 1 time was necessary the central pharmacy call (the same results was observed during 1 year provincial public hospital with about 700 beds, 4 hospital linked).

This kind of project was introduced by a multidisciplinary team according a risk management and ICT

Approach. Emergency and ICU clinicians, clinical pharmacist, informatics, engineers, nurse, toxicological med lab professionals and other. These systems in fact make possible to know rapidly the situation of expiration time of all antidotes stoked and so make easier the ordering process (some antidotes are rare or produced only in some countries and not in all nations- import procedure). Even to save 1 life is a golden endpoint in high risk situations as poisoning or terroristic attacks and an efficient ICT system can be the right solution.

Discussion and Conclusion

We strongly ask to international organization involved in hospital standard accreditations requirement to introduce as relevant instrument a informatics management system (cabinet informative or other systems) in logistics of antidotes. This will make possible a correct management and to have available the right antidotes in right time for the safety of the poisoned patients and also for professionals.

As we have seen in example for EMERGENCY DRUG HOSPITAL SYSTEMS we can have also a reduction in total costs providing an efficiency system. (Almost 53.000 euro in 5 years in an Italian public hospital) [14] we can think in example to total cost avoided if introduced in many national hospital.

This kind of experience can be usefully translated to antidotes and toxicology filed in many hospital places. This modify in routine can reduce mortality rate due by due by incorrect antidotes stokes logistics improving also the clinical outcomes related. In example we can see that in different hospital also the stokes and availability in some classic antidotes as activated charcoal can be insufficient and related the cyanide antidotes we have see that this is not correctly available in the different world hospital situation related to the difficulty to determinate the need of single hospital local situation (presence

of industries or other condition that contribute to the variability in the request).

Also the logistics of rare antidotes is a crucial process (the expiration time control and ordering procedure of this molecules can be part of an inefficient systems if not adequately controlled). We can also see that a velocity management ICT strategy can give improving in the efficacy of process related to logistics and to translate rapidly the relevant information in poisoning situations.

In our conclusion adding the ICT power and the clinical pharmaceutical care competences and knowledge added to the toxicological medical team we can have more clinical results, reducing mortality rate and healthcare costs [14-19].

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