**Results**

Results of this study reflected that requirements of using decision-support system in calculating dose of drug and warning about medicinal interaction, capability to use barcode technology, capability to connect with computerized provider order entry, capability to register expiration date and way and place of keeping drug are among the most important requirements of pharmacy’ information system. This importance may be attributed to problems related to frequency of medication errors ([Table 2](http://ijmi.ir/index.php/IJMI/article/view/111/206#T2)).

Based on results, most of the experts agreed with existence of capability to calculate dose of drug based on medicinal histories and physiological parameters of patient and ability to change units for usage. Study conducted on hospitalized patients reflected that 60% of medication errors are related to making mistake in drug dose or period of drug consumption [[28](http://ijmi.ir/index.php/IJMI/article/view/111/206#B28)]. Chertow and colleague showed in their study that using decision-support system results in 13% decrease in inappropriate dose and 24% decrease in inappropriate period of prescribing drug [[29](http://ijmi.ir/index.php/IJMI/article/view/111/206#B29)]. In other study, Teich and colleagues reflected that using decision-support system makes five kinds of progress in dose and period of using prescribed drug [[30](http://ijmi.ir/index.php/IJMI/article/view/111/206#B30)]. Evans and colleague introduced advanced decision-support system for prescribing antibiotics in that extent of parameters such as function of patient’ kidney, age and sensitivity of cultured organisms were being received and suggestions being presented about drug and its dose and using this system reflected considerable decease in side effects of drug, cost and duration of treatment [[31](http://ijmi.ir/index.php/IJMI/article/view/111/206#B31)]. Results of Nazzaro and Beary’ study reflected that making pharmacy equipped with computer system could increase pharmacy’ efficiency by calculating dose of consumed drug for outpatients and decrease time of preparing prescription up to 20% within two years [[32](http://ijmi.ir/index.php/IJMI/article/view/111/206#B32)]. Wager considered controlling dose of prescribed drug in proportion to age, weight, and other effective factors on patients as capability of a pharmacy’s information system [[33](http://ijmi.ir/index.php/IJMI/article/view/111/206#B33)]. Asadi and colleagues’ study reflected that preparing of medicinal histories of patient and calculating drug dose were being conducted in 46.1% and 30.7% of pharmacy’s information system of hospitals affiliated to Tehran Shahid Beheshti University of Medical Science, respectively [[16](http://ijmi.ir/index.php/IJMI/article/view/111/206#B16)]. Making mistake in drug dose is among the preventable prevalent medication errors [[34](http://ijmi.ir/index.php/IJMI/article/view/111/206#B34), [35](http://ijmi.ir/index.php/IJMI/article/view/111/206#B35)]. It is possible to get help from clinical decision support system in pharmacy’s information system in order to decrease medical errors and specify patient’ secure drug dose. This system can suggest secure drug dose for patients by registering patients’ characteristics such as weight, age, height, physiological and psychological parameters, co-morbid disease, consumed drug and patient’s reaction to those drugs.

Based on results, the most of experts confirmed capability to register expiration date and way and place of keeping good. Results of functional assessment of hospital information system’s soft wares in Iran confirmed that all under-study hospital information system’s soft wares do not make it possible to examine the requirement of managing drug inventory [[36](http://ijmi.ir/index.php/IJMI/article/view/111/206#B36)]. Saghaeiyannejad Isfahani and colleagues’ study reflected that soft wares existed in medical centers could not satisfy needed expectations in term of inventory management as one of the input, process and output criteria of pharmacist association [[23](http://ijmi.ir/index.php/IJMI/article/view/111/206#B23)]. In pharmacy information system, keeping an interior inventory entry of all medicinal products can help to pharmacy’s inventory management. When quantity of drug is fewer than usual quantity, pharmacy’ information system warns about it and prepares an electronic request that medicinal product would be prepared based on that and in an appropriate quantity from confirmed medicinal producer [[17](http://ijmi.ir/index.php/IJMI/article/view/111/206#B17)].

Table 2

Functional requirements of pharmacy’ information system

| **Users points of view** | **Completely agree** | **Agree** | **No comments** | **Disagree** | **Completely disagree** | **Total** | **Mean of score out of 4** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Functional Requirement** |

drug expire date should be considered.

if drug expire date is illegal, then report to DFCA

collect drug from foreign countries.

Load drug information in the computer including drug's expire date.

doctors must give prescription and doctors must sign on prescription.

doctors are responsible for sign on prescription.

doctors are responsible to give dosage.

doctors are also responsible to give schedule information for customers.

customers buy drugs from drug stores

customers must pay for the drug.

customers are not allowed to buy drug without prescription.

pharmacy will be charged, if customers report expired drug.

register expiration date

alert if drug expire date is approaching

check payment modality for medicine by individual, company or insurance

check drug storage location or shelf number

the system must register expiration date

display all drugs

total number of drugs in each medicine category

signal minimum reorder level for each drug type

show most frequently sold drugs

show selling and buying price of drug items

Compare drug items in storage and pharmacy’s inventory with amount in stoke during procurement

Show medicinal categorization( such as antibiotics, narcotics)

register way of drug consumption (such as oral, injection)

capability to register and edit medicinal and non-medicinal(such as cosmetics) drug items

show drug side effect

facilitate search and entry of drug items alphabetically

filter target medicinal items based on search parameters

electrically refer request of pharmacy to medicinal storage after proper approval by pharmacy head

management of drug with barcode

adjust drug dose based on medicinal history and physiological parameter of patient

the system must change units for consumption and suggest various options

make online connection with provider order entry

System must alert effect of interaction of drug-drug, drug-food, drug-allergy

access to scientific sources such as review database and medical studies

title of person writing prescription

|  |
| --- |
|  |
|  |
|  |
|  |

Show prescription type for special patients

Show time interval between two prescriptions (might cause additional side effects)

must comply with regulatory parties, such as, DFCA (drug and food control agency)

accurate and safe prescription managements system

The software is easily customizable

capable of generating various reports.

keeps a record of the supplier/manufacturer information from whom you buy the medicines/who is responsible for the manufacturing of those medicines.

information about expired items that need to be destructed

pharmacist

pharmacy software system must have the feature to load an entire data from an Excel/CSV file

**must have e-Signature Capture**to enable you to electronically track acknowledgment for each prescription.

Barcode based Point of Sale (POS) scanning, verification of dispensed product, which enhances efficiency and accuracy.

Support interface from mobile phone

Check confirmed medicinal producer with DFCA

Electronic notification or alerting to adverse drug reaction, medication error

Real time management reporting and trending capability that can be exported

Support mobile solutions

Integrated in-depth drug information

Every PPMS must support role-based access control by assigning users to roles based upon their job responsibilities, and assigning roles to access privileges based upon the information access needs of the users carrying out those roles.

Every PPMS must:

a) access a patient’s informational consent or disclosure directives, including the withholding or revocation of

consent to disclose information to third parties, where such directives are available to pharmacy professionals

from applicable jurisdictional EHR or client repositories;

b) enable an authorized user to record a patient’s informational consent or disclosure directives and then update

jurisdictional EHR or client repositories records where jurisdictional DIS or EHR component allow such updates

from a PPMS;

c) accomplish this in a way that allows each jurisdiction to comply with its own legal or policy requirements on

consent;

d) restrict access to electronic pharmacy records based upon a patient's informational consent or disclosure directives

in

addition

to

the

user’s

access

role;

and

e) enable an authorized user to obtain emergency access to patient records overriding previously recorded disclosure

directives

(where

emergency

medical

care

or

other

special

situations

permitted

by

law

or

policy

necessitate)

and

then

record in an audit log the invocation of such overriding access, along with a user-provided reason as to

why the consent directive was overridden.

Every PPMS must provide unambiguous direction to pharmacy professionals as to whether an e-prescription

constitutes the authoritative record of instructions to dispense or whether it is a copy (e.g., of a paper original) in

order to ensure that the prescription is acted upon only once and to thereby prevent a patient from improperly

filling it more than once.

Every PPMS must support the generation of offsite backup copies of all data

Must support localization

User friendly

Must have good response time

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1.capabiliy to define kind of pharmacy in term of referring( outpatient, hospitalization, outpatient and hospitalization) | 13(34.2) | 22(57.9) | 2(5.3) | - | 1(2.6) | 38(100) | 3.21 |
| 2. capability to define pharmacy, storage and stoke in unlimited number | 13(34.2) | 18(47.4) | 4(10.5) | 3(7.9) | - | 38(100) | 3.07 |
| 3. capability to specify kind of pharmacy in term of referring, special location, surgery room with possibility of setting calculation of all items in insurance at time of registering prescription | 15(39.5) | 21(55.3) | 2(5.3) | - | - | 38(100) | 3.34 |
| 4. capability to define different storage ( such as medicinal storage, consumed goods | 15(39.5) | 22(57.9) | 1(2.6) | - | - | 38(100) | 3.36 |
| 5. capability to register expiration date , way of keeping good and place of keeping good | 25(65.8) | 12(31.6) | 1(2.6) | - | - | 38 (100) | 3.63 |
| 6. capability to warn at time of ending good’ expiration date | 25(65.8) | 12(31.6) | 1(2.6) | - | - | 38(100) | 3.63 |
| 7. capability to set medicinal stoke of ward regarding expiration date and number of drug | 16(42.1) | 19(50) | 3(7.9) | - | - | 38(100) | 3.34 |
| 8. capability to enter and calculate drug and facilities consumed by patients in every shifts and specify stoke status of drug and facilities of each wards | 19(50) | 15(39.5) | 4(10.5) | - |  | 38(100) | 3.39 |
| 9. capability to set maximum inventory, order and sale threshold for all pharmacies and stores in exchange for each good | 16(42.1) | 17(44.7) | 4(10.5) | 1(2.6) | - | 38 (100) | 3.26 |
| 10.capability to momently display inventory of each good in all pharmacies and stores of hospitals including selling and buying price, expiration date and existence or non-existence in shelf | 18(48.4) | 15(39.5) | 3(7.9) | - | 2(5.3) | 38(100) | 3.28 |
| 11.capability to display consumed inventory of each good in all pharmacies and stores of hospitals( zero point) | 17(44.7) | 17(44.7) | 2(5.3) | 3(5.3) | - | 38(100) | 3.28 |
| 12.capability to warn about minimum inventory, order and sale threshold for all pharmacies and stores at time of registering documents and prescriptions | 14(36.88) | 19(50) | 4(10.5) | 1(2.6) | - | 38(100) | 3.21 |
| 13.capability to request for transmission among stores | 17(44.7) | 14(36.8) | 5(13.2) | 2(5.3) | - | 38(100) | 3.21 |
| 14.capability to electrically refer request of pharmacy to medicinal storage after confirming by technical manager of pharmacy | 19(50) | 14(36.8) | 4(10.5) | 1(2.6) | - | 38(100) | 3.34 |
| 15.capability to compare storage and pharmacy’s inventory with minimum stoke for each drug and warn in cases that inventory is of minimum stoke | 4(10.5) | 4(10.5) | 6(15.8) | - | - | 38(100) | 3.26 |
| 16.capability to state lack of drug inventory in pharmacy and medicinal storage at time of stating request of ward for drug | 23(60.5) | 11(28.5) | 4(10.5) | - | - | 38(100) | 3.5 |
| 17.capability to register returned drug | 18(47.4) | 18(47.4) | 1(2.6) | 1(2.6) | - | 38(100) | 3.39 |
| 18.capability to code drug(e.g. NDC) | 13(34.2) | 20(52.6) | 5(13.2) | - | - | 38(100) | 3.21 |
| 19.capability to define different variety of drug | 17(44.7) | 17(44.7) | 4(1.5) | - | - | 38(100) | 3.34 |
| 20. Capability to define variety of default texts in order to register way of drug consumption (such as oral, injection, inhaler) | 15(39.5) | 19(50) | 3(7.9) | 1(2.6) | - | 38(100) | 3.26 |
| 21.capability to define heads of consuming drug in pregnancy period(A, B, C,D, X) | 16(42.1) | 13(34.2) | 17(18.4) | 2(5.3) | - | 38(100) | 3.13 |
| 22.capability to define possible status of requesting drug’ importance( little, stat or maintenance) | 14(36.8) | 16(42.1) | 16(15.8) | 2(5.3) | - | 38(100) | 3.1 |
| 23.capability to define patient’ gender in order to register information of prescription(female, male) | 11(28.9) | 17(44.7) | 9(23.7) | 1(2.6) | - | 38(100) | 3 |
| 24.capability to define varieties of medicinal categorization( such as antibiotics, narcotics) | 18(47.4) | 18(47.4) | 1(2.6) | 1(2.6) | - | 38(100) | 3.39 |
| 25.capability to define varieties of categorization for items( such as drug, consumed facilities, cosmetics) | 15(39.5) | 18(47.4) | 3(7.9) | - | 2(5.3) | 38(100) | 3.15 |
| 26.capability define varieties of packaging with its coefficient in order to register number of good | 16(42.1) | 16(42.1) | 3(7.9) | 3(7.9) | - | 38(100) | 3.18 |
| 27.capability to register and edit all needed medicinal and non-medicinal items of hospital | 20(52.6) | 13(34.2) | 4(10.5) | 1(2.6) | - | 38(100) | 3.36 |
| 28.capability to have medicinal and facilities entry alphabetically | 19(50) | 18(47.4) | 1(2.6) | - | - | 38(100) | 3.47 |
| 29.capability to filter entry of medicinal items based on search parameters | 14(36.8) | 20(52.6) | 3(7.9) | 1(2.6) | - | 38(100) | 3.23 |
| 30.capability to print entry of medicinal and non-medicinal items | 18(47.4) | 18(47.4) | 1(2.6) | 1(2.6) | - | 38(100) | 3.39 |
| 31.capability to register other additional information of each drug categorically in order to needed usage | 18(44.7) | 15(39.5) | 15(13.2) | 1(2.6) | - | 38(100) | 3.26 |
| 32.capability to register medicinal side effects of drug | 13(34.2) | 21(55.3) | 4(10.5) | - | - | 38(100) | 3.23 |
| 33. management of drug and facilities’ entry through barcode | 27(71.7) | 30(26.3) | 1(2.6) | - | - | 38(100) | 3.68 |
| 34. managing filling prescription through barcode | 28(37.7) | (23.7)9 | 1(2.6) | - | - | 38(100) | 3.71 |
| 35.capability to calculate drug dose based on medicinal history and physiological parameter of patient and ability to change units for consumption | 29(76.3) | 7(18.4) | 2(5.3) | - | - | 38(100) | 3.71 |
| 36.capability to recognize and warn about non-conformity of prescribed drug with diagnosing the disease and physiology of patient | 25(65.8) | 8(2101) | 4(10.5) | 1(2.6) | - | 38(100) | 3.5 |
| 37.capability to make direct connection with computerized provider order entry | 28(73.7) | 11(28.9) | - | - | - | 38(100) | 3.73 |
| 38. Capability to diagnose and warn about interaction of drug-drug, drug-food, drug-allergy, drug-results of test and… | 27(71.1) | 11(28.9) | - | - | - | 38(100) | 3.71 |
| 39.capability to warn about riskiness of prescribed drug for patient | 25(65.8) | 12(31.6) | 1(2.6) | - | - | 38(100) | 3.63 |
| 40.access to scientific sources such as review database and medical studies | 21(55.3) | 16(42.1) | 1(2.6) | - | - | 38(100) | 3.52 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 41.capability to electronically receive request and send answers of medicinal counseling of clinical wards | 23(60.5) | 12(31.6) | 3(7.9) | - | - | 38(100) | 3.55 |
| 42.capability to support system of managing confidential and anonymous danger (such as giving report of error) | 23(60.5) | 12(31.6) | 2(5.3) | - | - | 38(100) | 3.52 |
| 43.capability to electronically receive and send list of requested drug by clinical wards | 23(60.5) | 11(28.9) | 4(10.5) | - | - | 38(100) | 3.5 |
| 44. capability to determine whether a drug is narcotic or not | 14(36.8) | 18(47.4) | 5(13.2) | - | 1(2.6) | 38(100) | 3.15 |
| 45.capability to define varieties of physician’ specialty | 14(36.8) | 13(34.2) | 10(26.3) | 1(2.6) | - | 38(100) | 3.05 |
| 46.capability to define title of person writing prescription | 10(26.3) | 21(55.3) | 6(15.8) | 1(2.6) | - | 38(100) | 3.05 |
| 47.capability to define authorized individuals who can sign for issuing permit of delivering drug | 14(36.8) | 21(55.3) | 3(7.9) | - | - | 38(100) | 3.28 |
| 48.capability to define name of units authorized to issue permit of delivering drug | 15(39.5) | 18(47.4) | 5(13.2) | - | - | 38(100) | 3.26 |
| 49.capability to define verities of permits of delivering drug | 14(36.8) | 18(47.4) | 6(15.8) | - | - | 38(100) | 3.21 |
| 50.capability to define name of companies of contracting party to register invoice of drug | 16(42.1) | 19(50) | 2(5.3) | 1(2.6) | - | 38(100) | 3.31 |
| 51.capability to register invoices of buying and producer and manufacturer companies and send report to accounting unit | 12(31.6) | 20(25.6) | 6(15.8) | - | - | 38(100) | 3.15 |
| 52.capability to define prescription rules for delivering or not delivering drug including prescribing by special physician, prescribing just for special patients, rationing number and time interval between two prescriptions ( is important for outpatient patients | 15(39.5) | 9(50) | 3(7.9) | 1(2.6) | - | 38(100) | 3.26 |
| 53.capability to warn and accurately examine the prescription rules for delivering or not delivering drug including prescribing by special physician, prescribing just for special patients, rationing number and time interval between two prescription( is important for outpatient patients) | 14(36.8) | 9(50) | 5(13.2) | - | - | 38(100) | 3.23 |
| 54.capability to register characteristics of drug producers including characteristics of company, list of produced drug, dose, shape, and buying price of drug | 13(34.2) | 18(47.4) | 7(18.4) | - | - | 38(100) | 3.15 |
| 55.capability to define drug package to accelerate selecting number of drug in document and prescription in unlimited number with capability to give barcode | 11(28.9) | 21(55.3) | 4(10.5) | 2(5.3) | - | 38(100) | 3.07 |
| 56. capability to define verities of working group in order to separate observing medicinal items( observing a number of drug for some users to use in case of having access permit | 12(31.6) | 20(52.6) | 4(10.5) | 1(2.6) | 1(2.6) | 38(100) | 3.07 |
| 57. Capability to control name and surname of patient, validity date of health insurance card, name and surname of physician and medical counsel number at time of writing prescription | 15(39.5) | 18(47.4) | 5(13.2) | - | - | 38(100) | 3.26 |
| 58.capability to define varieties of titles of technical right( such as filling prescription on day and at night) | 13(34.2) | 20(52.6) | 4(10.5) | 1(2.6) | - | 38(100) | 3.18 |
| 59. capability to set calculating technical right of outpatients or hospitalization in franchise percentage of each insurance | 14(36.8) | 16(42.1) | 7(18.4) | - | 1(2.6) | 38(100) | 3.1 |
| 60.Capability define contracting party with registering franchise percentage of Outpatient and hospitalization and determining insurance ceiling in order to warn at time of registering patient’ prescription | 16(42.1) | 20(52.6) | 2(6.3) | - | 1(2.6) | 38(100) | 3.36 |
| 61. capability to determine extent of insurance ceiling in exchange of each specialty in order to warn at time of registering patient’ prescription | 19(50) | 18(47.4) | 1(2.6)1 | - | - | 38(100) | 3.47 |
| 62. capability to edit information of insurances of contracting party | 14(36.8) | 17(44.7) | 6(15.8) | 1(2.6) | - | 38(100) | 3.15 |
| 63. capability to define unit price of accepted by insurance based on outpatient prescription, hospitalization prescription and prescription of special place such as operation room | 15(39.5) | 18(47.4) | 5(13.2) | - | - | 38(100) | 3.26 |
| 64. capability to calculate price accepted by insurance out of selling price of good in prescription | 18(44.7) | 18(44.7) | 2(5.3) | 2(5.3) | - | 38(100) | 3.28 |
| 65. capability to print price of patients’ prescription on page of health insurance card in order to present to insurer organizations | 14(36.8) | 19(50) | 4(10.5) | 1(2.6) | - | 38(100) | 3.21 |
| 66. Capability to round Cost of patient’ portion in prescription | 11(28.9) | 20(52.6) | 4(10.5) | 3(7.9) | - | 38(100) | 3.02 |
| 67. capability to set registering OTC prescription ( registering prescription without health insurance card ) | 18(47.4) | 11(28.9) | 7(18.4) | 1(2.6) | 1(2.6) | 38(100) | 3.15 |
| 68. capability to display messages in case of not applying insurance because of limitation of good | 14(36.8) | 15(39.5) | 8(21.1) | 1(2.6) | - | 38(100) | 3.1 |
| 69. capability to set printing detailed report of prescription in needed number | 14(36.8) | 18(47.4) | 5(13.2) | 1(2.6) | - | 38(100) | 3.18 |
| 70. capability to set selecting insurance as default for registering prescription based on selecting latest insurer | 12(31.6) | 18(47.4) | 6(15.8) | 1(2.6) | 1(2.6) | 38(100) | 3.02 |
| 71. capability to define accepted number of drug for insurance for exchange of each patient’ prescription in order to warn at time of registering prescription | 17(44.7) | 14(36.8) | 7(18.4) | - | - | 38(100) | 3.26 |
| 72. capability to register one insurance or selecting all insurances for covering a good | 13(34.2) | 18(47.4) | 7(18.4) | - | - | 38(100) | 3.15 |
| 73. capability to register one insurance or selecting all insurances for covering all items | 14(36.8) | 18(44.7) | 6(15.8) | - | 1(2.6) | 38(100) | 3.13 |
| 74. capability to delete one or all insurances for not covering a good | 14(36.8) | 17(44.7) | 18(21.1) | 1(2.6) | 1(2.6) | 38(100) | 3.02 |
| 75. capability to make similar the tariff of insurances of contracting party for covering good | 14(36.8) | 17(44.7) | 6(15.8) | 1(2.6) | - | 38(100) | 3.15 |
| 76. capability to define specialty limitation for good in exchange of covered insurances in order to warn at time of registering patient’ prescription | 13(34.2) | 19(50) | 6(15.8) | - | - | 38(100) | 3.18 |
| 77. capability to make similar based on specialty limitation in exchange of one or few insurances or insurers | 12(31.6) | 18(47.4) | 7(18.4) | - | 1(2.6) | 38(100) | 3.05 |
| 78. capability to make similar based on specialty limitation in exchange of one insurance of good for other insurances of that good | 12(31.6) | 18(47.4) | 8(21.1) | - | - | (100)38 | 3.1 |
| 79. capability to have sub-system in order to introducing herbal and chemical drug of Iran and world ,including name of drug, names of other drug, shape and way of effecting, pharmacokinetic, case of consumption, consumption prohibition, interference in test and possible side effects | 24(63.2) | 8(21.1) | 3(7.9) | 3(7.9) | - | 38(100) | 3.39 |
| 80. capability to define varieties of medicinal exceptions for hospitalized, outpatients and lesser than six hours patients | 24(63.2) | 10(26.3) | 4(10.5) | - | - | 38(100) | 3.52 |
| 81. capability to dedicate tracking code to patients’ prescription in order to ease nurses and secretaries’ work | 23(60.5) | 13(34.2) | 2(5.3) | - | - | 38(100) | 3.55 |