NHS Connecting for Health	Draft Guidelines for Hazard Review of ePrescribing Systems			
	Programme	NPFIT	DOCUMENT RECORD ID KEY	
	Sub-Prog / Project	ePrescribing	*NPFIT-EP-DB-0021.03*	
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	Version Date	Aug 2008	Status	Baseline

Guidelines for hazard review of ePrescribing systems

Amendment History:

Version	Date	Amendment History
0.1	Dec 2007	First draft for comment
0.2	Jan 2008	Update following comments from Clinical Safety team
0.3	Jan 2008	Update following comments from LSPs
0.4	Feb 2008	Addition of references
0.5	Mar 2008	Consultation text added
0.6	May 2008	Comments from NPSA
0.7	August 2008	Addition of consultation comments
0.8	August 2008	Edit/board review version
1.0	September 2008	Baseline version for publication

Forecast Changes:

Anticipated Change	When
Review following reported patient safety incidents	Ongoing

Reviewers:
This document must be reviewed by the following. Indicate any delegation for sign off.

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Distribution:
Circulated nationally

Document Status:
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Related Documents:
These documents will provide additional information.

Ref no	Doc Reference Number	Title	Version
1	NPFIT-SHR-QMS-PRP-0015	Glossary of Terms Consolidated.doc	V12
2	NPFIT-EP-DB-0010.08	ePrescribing Functional Specification	V1.0

1.0 Purpose

There are currently no nationally agreed guidelines that outline the key safety related features that should be present within electronic prescribing systems. This paper seeks to identify a core set of design-related safety features that suppliers should be looking to have present in the future and/or hazards that should be mitigated to ensure that previous lessons learnt are not forgotten. The long term aim is to develop these guidelines into information standards for use throughout the NHS in England.

1.1 Background

Electronic prescribing systems have been shown to reduce errors associated with the prescription, supply and administration of medicines [1,2,3,4,5]

They have also been shown to introduce errors some of which are new error types e.g. mis-selection from lists[6]. There is an opportunity to learn from the experience of deployed systems to introduce specific design-related safety features that should be present within all ePrescribing (eP) systems. These features assist in ensuring accurate medication selection, display and association of appropriate attributes such as route and form. Whilst there are many features that could be used to reduce the risk of error this paper highlights those that are considered to be key.

In accordance with the Chief Medical Officer reports of 2005 and 2006[7] that highlight that the NHS must learn from incidents, the content of these guidelines is based on problems and learning that have been identified with paper prescribing, reported incidents, known errors associated with electronic systems and anecdotal evidence from those currently using electronic systems.

Prospective management of known hazards should improve the safety of systems deployed whilst not impacting on user experience or workflow. Not all of the features identified below will need to be present in all systems

depending upon the setting and the functionality provided. It is also acknowledged that hazards identified may be mitigated via alternate mechanisms within different systems.

These guidelines incorporate comments received from a wide range of individuals and organisations. They will continue to be updated following incidents reported from which there is learning that can be acted upon or following user feedback about potential errors that could be avoided.

1.2 Out of Scope

Specific safety related guidance for active decision support for ePrescribing is excluded from this guideline e.g. drug-drug interactions, allergy checking etc. It will be addressed within a future review to allow for research currently underway to better inform the content.

1.3 Feedback

Comments on the content of the guidelines are welcomed at any time. We would also welcome reports that detail incidents or near misses that may highlight specific design related issues that should be considered for inclusion. If you have any comments or information that you would like to have considered please send it to either eprescribing@nhs.net or report it to the national helpdesk safety.incident@nhs.net

Guidance topics

2.0 Specific hazards / patient safety design features
3.0 Selecting a medicine for prescribing
4.0 Composing a prescription
5.0 Order sentences
6.0 Order sets
7.0 Medicines display
8.0 Authorising prescriptions
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10.0 Administration of medicines
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14.0 Drug file / catalogue and clinical content
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2.0 Specific hazards/ patient safety design features

	Feature	Rationale
2.1	Possible to access, for editing, only one patient at a time for either prescribing or administration functions	To reduce the risk of prescribing or administering the wrong medicine to the wrong patient
2.2	Clear banner detailing which patient is currently being accessed must be visible on every screen even when scrolling through information	Must be clear at all times to ensure that correct records are read and written for right patient[8]
2.3	Access to prescribing can be limited according to designated user's prescribing rights	Legal requirement coupled with need to ensure authorised.
2.4	Access to administration recording limited according to user type	Required to ensure authorised/ competent to administer medicines
2.5	Separate function available for access to allow for prescription details to be viewed by those that need access to the information without the need to prescribe and/or administer i.e. separation of viewing and editing functions	Allows other health care professionals to access a record without being able to alter it
2.6	Where different types of prescription/prescription setting are available, these are clearly specified and separately accessed e.g. inpatient, discharge, outpatients etc	Too easy to prescribe for the wrong scenario e.g. discharge rather than inpatient and put patients at risk as they may miss doses etc
2.7	Access to prescribing pathways must be clear and intuitive	Need to ensure users are aware when entering functionality that allows prescribing and thus conforms with associated legal requirements.

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3	**Selecting a medicine for prescribing:**	
	Feature	**Rationale**
3.1	Typing in a medicine description should return an increasingly shortened list as more characters are added	Allows for reduced selection error
3.2	Lists returned should be ordered according to altering priorities depending on the medicine being selected e.g. grouped by name, strength, form and frequency of use etc.	Known problems with mis-selection if lists are not ordered within groupings
3.3	Lists returned must only contain 'medicinal'* products and must not be lists that can be used for placing other non-prescription related orders.	To reduce the likelihood of mis-selection or misinterpretation of the functionality currently being utilised
3.4	High risk medicines* should be highlighted within lists for selection or as part of a returned list The manner of highlighting should reflect the reason for potential mis-selection e.g. similar strength, similar name etc	To reduce the likelihood of mis-selection of look alike, sound alike medicines (LASA) e.g. penicillamine for penicillin; morphine solution for morphine concentrated solution.
3.5	Lists returned should not contain truncated descriptions	Increased likelihood of mis-selection error
3.6	Lists returned when prescribing for paediatric patients should contain paediatric preparation preferences as a priority (if possible separate formularies should be available to support this)	To reduce the possibility of adult formulations being prescribed inappropriately.
3.7	When access to define freetext medicine descriptions is available, this route must not be as easily accessible as selection from pre-defined medicine descriptions	To reduce the likelihood of this route being utilised in preference for prescribing. No decision support and possibility of incorrect or incomplete orders being produced
3.8	If freetext medicine descriptions are utilised there must be clear warnings about the lack of decision support	To ensure that prescribers are aware of the need to undertake checks and are not reliant on system checks.

* These are defined as individual medicinal products (medicines, appliances and personal medical devices) that are available within the NHS for the treatment, diagnosis or alleviation of discomfort in human patients.
*High risk medicines are defined as those that may be mis-selected from a drop down list or mis-read within a prescription. These will include look-alike sound-alike medicines, products that are adjacent to each other that have strengths that differ by only one number e.g. 10mg/5ml versus 100mg/5ml etc.

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4	**Composing a prescription:**	
	Feature	**Rationale**
4.1	If selectable, drug form (e.g. tablet, injection etc) should be limited to those appropriate for the medicine name selected	Reduce the likelihood of a mis-selection and composition of a medicine that does not exist. May also be driven by formulary availability.
4.2	The unit of measure for the dose and/or volume should be limited to allow for selection of only those that are appropriate for the medicine selected.	To reduce the likelihood of an incorrect dose being selected e.g. grammes in place of milligrams
4.3	Units of measure descriptions/abbreviations must comply with those defined within dm+d editorial policy	To ensure consistency of description and to avoid the inappropriate use of shortened forms or abbreviations which may be misinterpreted
4.4	The route selection should be limited to those that are pertinent to the medicine combination(s) selected (i.e. medicine name and e.g. form or strength) and/or should exclude routes that are considered to be unsafe	To reduce the likelihood of a medicine being administered via an inappropriate route for the form and/or strength/dose selected
4.5	Where a route requires a qualifier this must be automatically presented for choice within a limited list to ensure that it is included within the prescription (without automatic selection being possible) e.g. left, right or both eyes	Ensures that complete administration information is available for patients, carers and nurses administering medicines
4.6	The frequency selection should be limited to those that are appropriate for the medicine combination(s) selected for their intended use e.g. for methotrexate oral tablets once weekly	To reduce the likelihood of errors being made due to mis-selection or lack of knowledge
4.7	Appropriate templates, with mandatory fields where necessary, should be completed for different medication order and prescription types	To ensure that prescription details contain all of the information required to safely dispense and administer them

4.8	It must not be possible to complete a prescription with a series of identical keystrokes e.g. multiple carriage returns	Different types of keystroke/intervention must be made to ensure that defaults are not automatically returned resulting in an inappropriate prescription or content

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5	**Order sentences:**	
	Feature	**Rationale**
5.1	Where these are available they must contain all of the information required for a individual prescription and if not it must be obvious which elements require completion before the order can be placed	To ensure that prescription details contain all of the information required to safely dispense and administer
5.2	Where there are multiple sentences available it should be possible to group these according to an agreed priority	To reduce the risk of mis-selection errors being made as orders may look similar in all content bar e.g. frequency
5.3	Where both paediatric and adult order sentences are available they must be clearly separated	To reduce the risk of adult doses being prescribed for children

6	**Order sets:**	
	Feature	**Rationale**
6.1	It must not be possible to select all the components of an order set with one key stroke or mouse click	Reduces the likelihood of incorrect or inappropriate orders being placed for a patient due to user not reading full list
6.2	Each individual component must be checked i.e. positively selected for inclusion	Requires users to read and definitely require each item – safer as must assess each component for individual patient

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7	**Medicines display[9, 10]:**	
	Feature	**Rationale**
7.1	Order details (i.e. the medicine line content) must be complete and not have any details truncated or abbreviated (bar those abbreviations that have been approved by NHS CfH programmes and/or the Information Standards Board).	Non-standard abbreviated or truncated names may miss out vital detail and lead to error or be misinterpreted leading to error
7.2	Text-wrapping of medication details is acceptable but must not wrap in mid-word or mid-attribute e.g. 10 mg	May be misread leading to error
7.3	The individual components of an order must be clearly separated to ensure that blurring of information is not possible e.g. a drug name running into a strength or dose	Misinterpretation possible and has been reported in the US.
7.4	There must be no trailing zeros after decimal points e.g. 5.0mg	Can be misread as one decimal higher with the zero – has been reported
7.5	There must a leading zero before a decimal point where appropriate e.g. 0.5mg. Where possible decimal integers should be avoided unless part of a range i.e. 0.5mg should be expressed as 500 micrograms, but 0.5 – 2mg is acceptable.	Can be misread as higher dose without the zero – has been reported.
7.6	Different types of prescription must be clearly differentiated if listed within the same list e.g. inpatient versus discharge	To reduce the likelihood of confusion which could lead to medicines being missed for e.g. either inpatient administration or discharge supply
7.7	Displays of medicines should relate to one episode/spell of care only unless specifically selected as otherwise by the user	To reduce the potential for misinterpreting information presented and acting inappropriately.

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8	**Authorising prescriptions:**	
	Feature	**Rationale**
8.1	There must be a clear stage/step which identifies where prescriptions are 'signed' and therefore available for dispensing/administration on completion	To reduce the likelihood of actions not being completed and/or reminding users that prescriptions are 'live'
8.2	This stage must enforce a review of what is being authorised	To reduce the likelihood of errors made during the selection process being carried through to the final prescription
8.3	Countersignature (e.g. for medical students) of prescriptions must ensure that a full review of each prescription item is undertaken i.e. multiple items may not be authorised with one key stroke	Reduces the likelihood of incorrect or inappropriate orders being placed for a patient due to user not reading full list

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9	**Administration access:**	
	Feature	**Rationale**
9.1	It must not be possible to edit administration recording for more than one patient at a time	To reduce the possibility of the wrong medicine being given to the wrong patient inadvertently
9.2	It should be possible to move through a ward or other patient list with specific safeguards to ensure that the user is aware of the change of patient record being accessed	To aid workflow whilst reducing the risk of the wrong medicine being given to the wrong patient
9.3	High level lists outlining patients that have medicines overdue/due should not contain sufficient detail to allow for administration or have the ability to record administration as part of the functionality	To reduce the possibility that medicines might be given with supposition as opposed to the full information being accessed when users are in a hurry.
9.4	To aid medicine preparation, where it might be required, it must be possible to either display sufficient detail on	To reduce the need to transcribe details for preparation. Transcription carries a risk of error.

	screen and/or allow for a printout to be produced (where printouts are produced patient details must be present on each printed page.)	
9. 5	It must not be possible for more than one user to access administration recording pathways for the same patient at the same time (other than where witnessing is required)	To reduce the likelihood of the wrong patient receiving the wrong medicine or multiple doses of the same medicine.

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10	**Administration of medicines:**	
	Feature	**Rationale**
10.1	The administration screen must clearly display which medicines are ‘due’, ‘overdue’ or ‘when required’	To reduce the likelihood of medicines being given at the wrong time
10.2	Grouping of the individual components should default to highlight the overdue medicines as a priority	To reduce the likelihood that these medicines will be overlooked
10.3	Where lists are longer than the available screen space it must be clear that there are other medicines that may need to be viewed	To reduce the likelihood that some medicines may be inadvertently missed
10.4	The details of the medicine to be given must clearly display the medicine, dose to be administered and the route/ method of administration (where appropriate).	To ensure that clear directions that are clearly displayed are given reducing the risk of error due to mis-reading
10.5	Previous administration details should be available for access/view from within administration pathways	To reduce the risk of administration being undertaken without full historical details being available which may impact on the decision as to whether to administer or not e.g. for PRN medicines
10.6	The display of medicines within the administration pathways should be consistent with the requirements in Section 13	To reduce the risk of misinterpretation leading to medication error
10.7	It must not be possible to record the administration of more than one medication line item with	Requires users to read and definitely administer each item – safer as must assess and record

	one keystroke. Each individual item must be separately recorded.	each component for an individual patient
10.8	When IV infusions have been prescribed which require the use of multiple infusion bags, it is important that a no prompt is given to administer the second or subsequent bags until the previous one has been recorded as complete	To reduce the risk of multiple bags of fluid being given simultaneously.
10.9	Semantics for recording administration should conform to those highlighted within the eP functional specification e.g. given, not given etc	To reduce the risk of misinterpretation when moving between systems
10.10	Once a medicine has been recorded as administered it must not be possible to re-administer without accessing the item via a specific pathway that requires a reason to be given	To reduce the risk of a medicine being administered twice or being recorded as being administered twice
10.11	Documentation of witnessing of administration should not be so 'complex' as to mean that focus on the witnessing is lost	To reduce the risk of the witnessing being a secondary task to the recording of the action potentially leading to error
10.12	Where specific notes may have been added to aid administration these must be visible and not hidden behind an icon. If necessary the notes may be truncated.	To reduce the risk of specific warnings or advice etc being missed and leading to inadvertent error

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11	**Quick administration pathways:**	
	Feature	**Rationale**
11.1	It should be possible to limit access to these pathways according to medicine and/or route and/or user	To ensure that they are not used as a default in situations that could inadvertently cause error thorough lack of information being available or poor recording
11.2	Pathways must not allow for administration of more than one medicine with one keystroke	Requires users to read and definitely administer each item – safer as must access and record each component for eachpatient

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12	**Suspended medicines:**	
	Feature	**Rationale**
12.1	**Suspended medicines:** The act of suspending a medicine (temporarily suspending the administration of a prescribed medicine) must be limited to authorised users (as it is effectively a prescribing decision)	To ensure competent to do so
12.2	Suspended medicines must be visible within all views of the medication record and must be clearly highlighted as being suspended	To reduce the likelihood of inadvertent error due to lack of knowledge of current full medication record
12.3	Suspended medicines must not be available for administration but may be viewed within administration pathways with clear differentiation from other medication types	To reduce the likelihood of inadvertent administration whilst ensuring that information about the full current record is available
12.4	Suspended medicines should be un-suspended individually. It should not be possible to un-suspend a list with one keystroke	Reduces the likelihood of incorrect or inappropriate orders being placed for a patient due to user not reading full list

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13	**Patient Group Directions (PGD's):**	
	Feature	**Rationale**
13.1	Access to PGD functionality must be limited to appropriate users	To comply with legal requirements and to ensure competence
13.2	Separate functionality for supply and administration or both must be available	To allow for specific access as may be outlined within the PGD – legal requirement
13.3	Access to prescribing pathways to record PGD's in place of specific functionality must not be possible	To comply with legal requirements and ensure competence
13.4	Limited lists of medicines that may be handled via a PGD should be utilised rather than the full formulary – if possible	To ensure that users do not inadvertently select the wrong medicine. Given that they are working within a limited list this

	these should be user specific	reduces the likelihood of error if lists contain items that look similar and may lie outside their expertise
13.5	Medicines supplied or administered under a PGD must appear within the medicine record detail appropriately flagged – as a PGD	To reduce the likelihood of error if complete details of the medication record are not available

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14	**Drug file / catalogue and clinical content:**	
	Feature	**Rationale**
14.1	There must be well defined and validated procedures with checking mechanisms in place for the upload and update of drug file content	To reduce the possibility of incorrect components being incorporated or incorrect detail displayed etc
14.2	There must be clear procedures for ensuring that existing content remains unchanged other than where it has been highlighted as being altered and tested/validated	To ensure that the full detail of an update is available such that the risk of inadvertently updating or negating a previous correction etc is reduced
14.3	Formulary and other local catalogue/clinical content that is defined/maintained must have separate access controls to allow for defined/restricted access	To reduce the likelihood of local work being inappropriately overwritten or updated by users who not aware of the sequelae of such actions
14.4	Medicines that have been discontinued by the manufacturer should be clearly identified	To allow for systems to be put in place to reduce the likelihood of items being prescribed that are no longer available
14.5	Mapping standards defined by NHS CfH must be complied with	To ensure that the strategy to reduce the risk of incorrect mapping being present is being followed

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15	**Miscellaneous issues:**	
	Feature	**Rationale**
15.1	Printed prescriptions must be	To reduce the risk of previous

	managed to ensure that data is not held in buffers	prescription details being translated onto a subsequent printout which may be for another patient

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16	**Medicine specific hazards:**	
	Feature	**Rationale**
16.1	***Insulin:***	
16.1.1	Must be prescribed by brand name	To ensure that the correct brand, source and presentation of insulin is described
16.1.2	The only unit of measure available for selection is 'Unit'	To reduce the likelihood of inappropriate units of measure being utilised e.g. mL
16.1.3	'Unit' is described in full	To reduce the likelihood of unit (U) being misread as a zero

16.2	***Warfarin[11]:***	
16.2.1	Dose instructions, in acute care settings, must be clearly defined as a number of mg	To reduce the likelihood of dose being misinterpreted
16.2.2	Access to related INR results should be readily available including (but not limited to) • Date of the last test • Result of the last test	To support the need for regular INR monitoring required to support safe use and mandated by the NPSA
16.2.3	Interaction alerts should clearly describe the potential clinical impact. In future a clear alerting philosophy should be defined to support this.	To ensure that alerts clearly outline the actions required to support safer management
16.2.4	It should be possible to record details of information given to the patient	To ensure that patient has received appropriate information and understands the issues related to anticoagulant use.

16.3	***Methotrexate[12]:***	
16.3.1	Access to dosing schedules of greater than once weekly should be limited to specialist areas alone	To reduce the likelihood of the inappropriate prescription of daily doses

16.3.2	Warnings about the need for weekly prescribing must be prominent. (Where policy dictates that specific strengths of tablet must be used, this must also be supported.)	To remind prescribers about the need for vigilance in frequency selection
16.3.3	Access to relevant blood test results should readily available where systems record this data	To ensure that appropriate monitoring is being undertaken as per NPSA requirement.
	It should be possible to record details of information given to the patient	To ensure that patient has received appropriate information and understands the issues related to anticoagulant use.

16.4	***Vinca Alkaloids***	
16.4.1	Ensure that access to the route 'intrathecal' is impossible for all vinca alkaloids	To reduce the likelihood of incorrect route selection

16.5	***Opiates:***	
16.5.1	Ensure that all modified release preparations are prescribed by proprietary and generic name	To reduce the likelihood of inappropriate selection of non-modified release products leading to high initial doses that may be dangerous
16.5.2	Ensure that concentrated strengths of liquid preparations are clearly identified and grouped within lists	To reduce the likelihood of mis-selection within picking lists particularly for higher strength products
16.5.3	Ensure that strength and/or dose is clearly displayed in ascending order within pick lists where there is no clear rationale for altering this	To reduce the likelihood of mis-selection of products
16.5.4	Access to previous doses should be available where historical data is held on the system	To ensure that increases in doses are appropriate as required by the NPSA[13]

16.6	***Heparins:***	
16.6.1	Ensure that the word 'unit' is described in full	To reduce the likelihood of unit (U) being misread as a zero
16.6.2	Where relevant to ensure that the difference between the strength of the product selected	To reduce the likelihood of an incorrect dose being administered

	and the dose to be administered is clear Ensure that if strength of product is required to be selected, only those strengths available locally are available for selection.	
16.6.3	To ensure that access to relevant results is available easily	To facilitate the prescribing of correct dosages

16.7	***Oral Hypoglycaemics:***	
16.7.1	Ensure that the different preparations with look alike sound alike names are differentiated	To reduce the likelihood of mis-selection due to the look alike sound alike nature of some of these medicines

16.8	***Clozapine:***	
16.8.1	Ensure that access to blood results and monitoring results are available during both prescribing and administration	To reduce the likelihood of continued prescription or administration if adverse effects present
16.8.2	Ensure that supply requests/administration can be suspended pending the receipt of blood results	To ensure that medicine is not inadvertently administered without monitoring service permission

16.9	***Lithium:***	
16.9.1	Ensure that modified release preparations are prescribed by proprietary name	To reduce the likelihood of inappropriate selection of non-modified release products leading to fluctuating blood levels
	Access to relevant blood test results should readily available	To ensure that appropriate monitoring is being undertaken as good practice

16.10	***Digoxin:***	
16.10.1	Ensure that appropriate units of measure are used to describe the dose i.e. micrograms and not decimalised mg	To reduce the likelihood of dose misinterpretation

16.11	***Amphotericin:***[14]

16.11.1	Ensure that proprietary name is displayed as well as the generic description	To reduce the risk of the wrong product being prescribed and/or administered

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Appendix 1 – List of Contributors

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