Human Factors Annotated Checklist / Version 3.0

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Orientation to the Human Factors Annotated Checklist

The study of human factors generally deals with the interactions of humans with the systems in which they work. The goals of understanding human factors are; *to reduce error, to increase productivity, to enhance safety and to increase the comfort and job satisfaction of people working in systems.* There are a number of ways that people interested in human factors attempt to accomplish the latter goals. Strategies might emphasize modifications to the physical environment, task analysis and design, building better human-equipment interfaces, selecting the right people for the job, and providing appropriate training for individuals in the workplace.

The items in this checklist are based upon work in human factors broadly defined. They highlight important factors that anyone charged with managing quality assurance and patient safety issues should monitor. Comments are attached to items to provide further explanation or clarification. Also, references to sources for additional information on the information presented are listed.

The checklist does not cover everything there is to know. Rather it captures a number of issues that affect patient safety from my work and that of others that are within the 20% of things producing 80% of the problems. It is best used as a guide that can and should be modified to accommodate the unique needs and characteristics of individual institutions.

This annotated checklist is based upon research and experiences using a *Cognitive-Systems Model* of human performance [1,2,3,4] and the literature on human factors and medication errors. [5, 6, 7, 8, 9] Highlights of the model will be included as a part of my presentation into the causes of error. *This model provides a broad framework for organizing human factors principles and concepts related to medication safety concerns.* Specifically the *Cognitive Systems Model* addresses ways to understand and deal with the problem by calling attention to three arenas: a.) Factors contributing to human error that are system based; b.) Issues created by the interface of people with the systems in which they work; and c.) Error tendencies created by the way people integrate aspects of the systems in which they live and work into their mental processes. Such things often create stress, tension, and mental distractions that adversely affect performance.

Any one of the latter three areas provides an incomplete picture of the problem. A complete understanding of human error and safety involves paying attention to critical factors within and across each of the domains in the model. This holistic approach examines both *objective and tangible factors* in systems that effect performance and *subjective factors* such as the perceptions, moods, and stress levels of people on the job. Both the objective and subjective qualities of individuals and their interface with systems need to be identified, measured and explored.

There are three principles associated with this approach to improving patient safety:

- *Strong and effective systems make people more effective.* Work on things that modify and enhance the macro and micro aspects of the systems in which people work and thus encourage effective performance. Changes in procedures, rules, workflow, automation, the introduction of new technology and equipment, and other system changes help to make people effective.

- *Strong and effective people make systems more effective.* Work to develop and enhance the competencies and skills of people in the system and to insure that their needs are met. The idea of emphasizing people and their capabilities is not to "blame and shame" them for not performing in line with their competencies and skills. Rather the intent is to "think smart" about people.

  Thus in introducing workflow changes, automation, new roles, and other interventions designed to make the system more effective, one should always ask; "What needs of the people involved are affected, how will their energy and interests in the job change, and what skills will proposed changes affect *positively and negatively?* In this regard, organizations often fail by: a.) creating additional work for fewer people. b.) removing people from roles in which they were comfortable c.) placing them in unfamiliar new roles as if they were interchangeable parts, and d.) not involving or consulting with those affected by decisions. Instead, assumptions about what is "good for them" are made.

- *Interventions to reduce error and improve patient safety work best when they address both the needs of the system and the individuals who inhabit them.* Optimal solutions to problems of quality assurance and risk management occur when system and individual level needs are addressed. The question to answer is "What is in the best interests of the system, the people who work in it, and the individuals we serve? It's a question that involves three groups of players. It would be a mistake to find a solution that leaves one of the stakeholders out or that provides only minimal attention to their needs.

Categories of factors in the Cognitive-Systems Model related to accomplishing the latter goals are organized into the six components of the model. They include: *Task and Equipment Factors, Physical Environment; Personal Qualities, Interpersonal Relationship Issues, Organizational and System Dynamics, and Extra-Organizational Factors.* Important factors within the latter arenas that should be examined as a part of quality assurance and patient safety initiatives are embedded in the checklist items in this document.

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I: Task & Equipment Factors

A.]-Workflow

01]___ Pharmacy personnel understand that there is a risk of error under ***low as well as overly high levels*** of workload.

02]___ Priorities exist for completing tasks to help avoid overload and swings from low to high workload conditions. The chances of making mistakes increase with dramatic swings in workload conditions.

03]___After a lull in workload, when returning from breaks, beginning a shift, or during transitions in shifts, people recognize that errors are more likely to occur.

04]___ After a lull or break in workload, pharmacy personnel prepare themselves through mental rehearsal or by working on non-critical tasks to "warm-up" before continuing with dispensing activities.

05]___ Independent double-checks of work completed are initiated particularly for high-risk procedures and medications.

06]___ Actions are taken to simplify steps and interfaces in workflow and the distribution of completed work without sacrificing quality.

07]___ Critical work processes and procedures are standardized.

08]___ A "safe cockpit" is in place during critical parts of dispensing or medication preparation tasks. This can include an isolated workspace, the use of a light or other signals to warn others not to interrupt or an agreement to only disrupt with safety related questions or comments.

09] ___Workflow is simplified without sacrificing quality by reducing steps and interfaces whenever possible.

10] ___The components of workflow and the distribution of medications follow standardized processes and procedures. All procedures are written, personnel are trained in them and deviations from them are kept to an absolute minimum.

B.]-Monitor Work

01]___ Pharmacy personnel periodically monitor themselves for process errors (i.e., near misses, the relatively minor mistakes made and corrected, and general fumbling around that occurs during dispensing and medication preparation tasks. Increases in process errors are a behavioral indicator that people are drifting into an error mode. On average, for every six process errors per hour, one mistake can be expected to get past normal verification processes.

02]___ People monitor each other for increments in process errors. Remedial actions are taken that include taking breaks, giving those individuals affected extra-help, additional checks of work are initiated, people are switched to other tasks to provide relief, or those individuals affected perform less critical pharmacy tasks.

03]___Additional random checks are made of work otherwise completed and considered ready to be distributed. Or a check of 10% of all work completed and otherwise ready to be distributed is periodically undertaken as a regular quality assurance strategy.

04]___ Patient charts are randomly sampled and checked for the presence of medication errors attributable at least in part to pharmacy errors. Patterns

in such mistakes are noted and used to make recommendations for corrective actions. It would be ideal to have a more systematic and consistent checking of patient charts but random sampling can identify problems and patterns that need further attention.

05]___ Observers periodically monitor the work of pharmacists and other personnel involved in ordering and distributing medications. While the use of observers can be expensive, it is an effective way to identify specific types of errors and patterns in mistakes. A word of caution is in order here. Some organizations have used counts in errors on successive observations as a benchmark for how well they are doing. Keep in mind, that any observational scheme (i.e., outside observers or self-monitoring) can create heightened awareness in those observed. Thus, what one notices are errors made when people are likely more vigilant than is normally the case.

Thus, the "true rate of error" under the "usual conditions" of how people work is likely higher. It is always best to use a variety of strategies to monitor for medication errors over time and to look for common themes among them. Keep in mind the "Heisenberg Principle" which states that the method of observation changes the phenomenon being measured.

06]___Artificial errors are periodically introduced into the system to check on the ability of people and the system to track and capture mistakes. Such things are best accomplished during trial periods with individuals informed that such mistakes will appear during a specified period of time. People should not feel as if "big brother" is watching them but that the processes are designed to improve the ability of people and the system to manage errors. Insure that any ethical and formal organizational guidelines are followed in conducting such activities.

The use of artificial error strategies is very helpful in finding the "checking error rate" of people and the system. The checking error rate is the % of known errors that are missed when checking a set of materials that have artificial errors embedded in them. Artificial errors are helpful here because we then know for sure how many mistakes were in the set of outcomes checked. The checking error rate is important to any calculation of the "true error rate of the system or individuals."

The True Error Rate = Task Error Rate X Checking Error Rate. In this case, assume a 5% task error rate (e.g., dispensing error rate) and a 2% checking error rate , The true error rate is .05 X .02 = .0010 or .10%. In effect it helps us to understand how many undetected errors remain after an additional check beyond a normal final verification could be expected. It also helps us to identify the likely value of double-checks. In this case, about $1/10^{th}$ of 1% of undetected errors could mathematically be expected to remain if a double check were conducted.

07]___Artificial errors are periodically introduced to increase overall staff sensitivity to their ability to detect mistakes. The cognitive system's ability to detect errors is enhanced by giving people more experiences with

mistakes that they can identify and correct or at least receive feedback on those identified or missed.

A word of caution is appropriate here. While introducing errors into a system can be used to increase sensitivity to error, the effect may not be as straightforward as it seems. Under normal working conditions, the presence of additional errors in a system may paradoxically lessen sensitivity to finding mistakes. The 6:1 rate of process errors to those that get past normal verification mentioned earlier suggests that as more mistakes occur, the human cognitive system drifts into an error mode. This drift also lessens our ability to detect mistakes. Perhaps perceptual sensitivity drops or the internal criterion people use to decide if a mistake is present may become less stringent. People may come to believe; "there can't be that many mistakes present in what I'm doing." A self-fulfilling prophecy develops and they just don't see as many.

08]___ Independent double checks of work completed are carried out at least for high-risk tasks. The use of checking error rate information as described in the last item indicates why such strategies can be helpful. In effect, knowing the checking error rate for a task shows that when additional checks are independent, there will be a reduction in the percentage of undetected errors that remain.

Keep in mind that the estimates shown in the last two items are derived by simple mathematical calculations. The actual percentages can change depending upon estimates about the effects of fatigue, disliking double-checks, resentment that those initially doing the task were not more careful, feeling overburdened, etc. Such factors could adversely affect the checking error rate and thus it might be higher. However, the basic point would remain. If the checking error rate were 5%, then 95% of the remaining errors could be captured by the additional check.

09]___ Pharmacy safety teams are in place. They meet periodically, and they analyze the "lessons learned" from individual and group monitoring of work in process and completed.

10]___ Individuals as well as pharmacy teams use the feedback obtained about their performance to set explicit goals for improvement. Progress in meeting those goals are monitored and discussed with other members of the team.

11]___ Checklists are developed and used for high -risk tasks such as the preparation and use of high-risk medications and procedures.

12]___Pharmacy personnel, when involved in the preparation of high-risk medications work in isolation from normal workflow. This allows them to better monitor what they are doing and frees them up from unnecessary distractions. As a minimum, they have a way of signaling other pharmacy personnel to leave them alone until they are finished. Such work should always be independently double-checked.

C]-Attending to Equipment

01]___ Identify tasks where technology can be employed to reduce confusion and error.

02]___ Equipment / technology need to meet several criteria in order to promote their effective and safe use.

a. *A task relevant conceptual model is embedded in the design*. The product conveys the basis structure and function for which it is used. Thus, people can predict the probable effects of their actions when using the product. Think of a motorbike, a mountain bike, and a racing bike. Just looking at them allows us to imagine what they do and what would happen if handlebars were turned and if brake controls were engaged. It is also easy to imagine what would occur if we were riding one and were hit by a larger moving object such as a truck or car. On the other hand, look at any television remote control and think about the relative difficulty a novice or infrequent user would have determining how to "adjust the color balance."

b. *The controls used on the device facilitate a users ability to find easily and safely what they need.* Ideally a combination of visual, auditory, and tactile cues would be used to identify critical controls. Think of the functions you need to engage and their corresponding controls when driving a car. Now think about trying to program your videotape recorder using the remote control.

c. *Equipment used in low light or noisy environments have redundancies built into the controls*. That is, controls can be identified via more than one sensory channel, e.g., visual, auditory, tactile.

d. *Displays and controls convey a natural mapping of how things function and what the functions are that they serve.* Controls and displays for example map into how people normally assume things should work. Thus, moving controls to the right increases flow or quantity, blinking red lights signal a problem, display prompts are coordinated with console controls that should be pressed or engaged, i.e., the display says, "Continue" or "Discontinue." The console controls for such functions so are set-up "left to right" and beneath the display in order to correspond to the display prompts. Thus an action such as engaging the "Continue" function has a corresponding control that is located in close proximity to it. The control also appears in the same order on the console as it does on the display screen.

e. *The consistency with which users navigate the controls is appropriate and all controls are logically grouped and organized.* For an almost worst-case example of a violation of this principle look at a remote control device designed to control several pieces of equipment. Look no further than your multi-task remote for the television, VCR, DVD, and Stereo System. *The point is that people should not have to think about how to operate the equipment and what the controls mean or are designed to do.*

This principle also helps people who may only use the equipment periodically. Thus, they enter somewhat unfamiliar territory each time the encounter the device. It is not unusual to find them fumbling about or unsure about what to do. There is a warm-up associated with using a device infrequently that may lead to error. *Requiring periodic proficiency checks for personnel in this position is helpful to insure that they maintain competency.*

f. *Feedback is provided by display information, prompts, and assorted "bells and whistles".* It should be clear as the product is used what functions have been engaged, what the effects of any operator actions are, the current state of the system and any corrections needed.

g. *Feedback provided by displays should occur in real time and not involve unnecessary delays*. If a delay occurs, the system should be designed so the user knows that input has been received and the system is processing it. The clocks and hourglasses that appear on computer displays are one example of this principle. In the absence of such feedback, people have a tendency to re-do actions already entered, to overcorrect, or to quit and start over. *All of the latter actions affect reliability and accuracy.*

h. *Constraints are built into the equipment and controls so that unintended actions and uses are not possible.* This would include protections against *accidentally* turning a function "off" in the middle of a critical procedure, giving incompatible commands, or allowing the input of potentially hazardous settings

i. *Steps in error recovery are easy to understand and employ:* Mistakes by the operator or in the system the equipment/technology controls are noted. Alerts occur and it is clear what actions should be taken to correct them. It should be easy for the user to take back control if something goes wrong. Finally, any switch from "automatic" modes of operating back to "manual control" need to be engaged in a seamless and relatively effortless manner.

j. *The use of the equipment does not add unnecessary time or resources to the task.* Staff training, the time it takes to start the equipment and to reorient the operator must be added to the "tangible and intangible costs" of equipment and technology. Similarly, one should include in the cost the frequency of downtime, any needs for variations in work flow, additional procedures the equipment and technology require, work-a-rounds needed to use it properly and additional time to monitor the equipment. Such "hidden costs" can range from minor irritants to major issues creating needless stress and mental distractions that interfere with performance. They may also increase the "real financial costs" of the equipment making it less of a bargain than it seems.

03]___ Deficiencies in how equipment and technology meet the latter criteria are noted and remedial actions are taken to correct them. ***Conducting formal audits of such things is important*** because of a human tendency to "make do with what we have." In effect, people in any workplace normally accommodate less than ideal conditions. In the process, they set themselves up for making mistakes.

04]___ Operators of equipment receive training in its proper use and in ***how to recover from errors.*** Training personnel in error recovery is just as important as training in the proper use of the equipment. Such training should be conducted periodically with proficiency standards established that must be met and maintained.

05]___ When deciding how, when, and where to use new equipment / technology, ***the tradeoff between assigning the tasks to the more capable system versus a human operator is taken into account.*** The issue here is that tasks and functions can be automated or handled by technology or new equipment. The point to consider is whether or not they should be automated. A blind transfer of functions to machines is not a good idea. In some cases, people would prefer to perform the function and any shift to a machine may create problems with loss of autonomy and control, or dissatisfaction with the change. Such things cannot be ignored since they ultimately relate to whether any changes will be accepted and used as directed, job satisfaction, and personal levels of stress.

06]___In areas where automation and technology is used, and where it is appropriate to do so, ***the human operator is kept in the loop to maintain situational awareness.*** As long as individuals are involved in decision making regarding whether to accept the suggestions generated by automation or technology (e.g., able to veto unacceptable solutions), then situational awareness is maintained and personal workload is not dramatically increased. ***Remaining in the loop with even a minor task to perform also helps to combat any complacency associated with automation and technology.***

07]___Manufacturer claims of effectiveness, productivity increases, job satisfaction, workload reductions, etc., are verifiable. Unfortunately, pharmacy and medical equipment often lack independent assessments of their effectiveness, reliability and ability to be used immediately. Check in to claims, ask to see reports used to make the claims, and ask for a trial period of use before purchasing to determine whether similar benefits are available in your workplace.

08]___ End-users are able to check and evaluate equipment before it is bought or placed on-line. Set up a usability lab to check new equipment or technology before using it.

09]___Identify areas where additional constraints and/or forcing functions can be used to prevent misuse of equipment and the selection of wrong medications.

10]___Audit pharmacy equipment/technology for down time and repair records. Equipment that repeatedly fails is a hazard and a risk to patient safety. Treat equipment failures as the mechanical equivalent of human "process errors" (i.e., mistakes made and corrected). Little failures over time take a toll in lowering user satisfaction with equipment and become a precursor to bigger problems.

11]___Pay attention to and don't discount "complaints about equipment. Such perceptions lead to a lack of trust in equipment, create stress and tension, and are associated with error.

12]___ Take appropriate actions to correct problems behind equipment complaints. *A word of caution is in order here.* Sometimes the problem is with the equipment and its operation. At other times the problem may reflect frustration with being able to get something fixed in a timely manner or being asked to use a piece of equipment more than other members of the staff. Finally, equipment sometimes becomes the "fixation point" for other problems in the pharmacy or medication use system. It becomes a symbol of "what's really wrong around here." Thus, be careful how you define the problem. But remember that the stress and frustration is real and leads to negative emotions and mental distractions that can interfere with conducting a task properly.

13]___ Insure that displays on equipment and technology capture important information and do not confuse people. This point particularly applies to computer monitors where too much information is presented and people may miss important points.

14]___ Displays that simultaneously contain different classes of information (e.g., patient information, a scanned picture of an order or prescription, and a picture of the product to be dispensed) can be a problem. Attention naturally drifts to the most "visually interesting" part of the display. Thus, someone may not read the "dry" patient information but focus on the pictures of the product and prescription. Consider presenting the information in a sequence so that attention to each element individually can occur before all of the information is present. *Before doing so, make sure that this issue is a known problem with that particular piece of equipment or technology.*

15]___ Select equipment to use that can be operated safely and that is right for the job and the characteristics of the people who will be using it. Such things as education, training levels, experience with the task, age, and physical skills become important here.

16]___ Remain alert to the problem of complacency. It is a troublesome problem when people work with equipment that is normally reliable, safe, and accurate. Believing that "the equipment will not fail" or "a problem will not happen to me" is a precursor to a complacent driven error. Such mistakes occur because people believe that past experiences will normally repeat themselves in current circumstances. Personal signs that complacency are setting in are feeling smug, satisfied, invulnerable, and not worrying about the possibility of something going wrong. Periodically raising the problem with staff members helps as does holding educational sessions on known

problems caused by complacency. Managing complacency is best done as a team effort with people suggesting solutions to known problems and for ways to lessen the chances of it producing negative effects in the workplace.

D]-Task & Equipment Training

01]___ Personnel are adequately trained and "cross-trained" on tasks. Sometimes organizations try to skimp on training and instead rely upon "on the job" experiences to teach people what to do. This is not a good idea since the propensity for error is higher with less knowledge.

02]___Identify ways to introduce "low fidelity" and "high fidelity simulations to expose people to common problems with equipment. High fidelity simulations mimic as close as possible the actual environment (e.g., a simulated pharmacy operation that has many of the elements present of a actual pharmacy). A low fidelity simulation has elements of the actual environment but may have them located in a computer generated environment or simulation. Or, only several elements of the actual environment are in place. Low fidelity simulations are generally less expensive to operate but are not as high on ecological validity.

03]___Make sure personnel know what the signs of equipment / technology falling into a failure mode are and what specific remedial actions to take. *Don't just tell them what could happen, give them experiences managing a failure and periodically update that knowledge and skill with additional exposures to problems.* Mental scripts for thoughts and actions to manage such things need to be developed and utilized. And, people often need to see, touch, and feel what something is like to gain optimal benefits from the experience.

04]___When bar coding and scanners are available, audit to insure that the equipment is being used properly and as directed. A number of clever work-a-rounds to such devices have been developed by people who believe they can work faster, safer, and more effectively without them. While one can 'force compliance," it is often better to initially engage in "educational interventions" and to have an open discussion of the advantages and disadvantages of technology. Some of the reasons for noncompliance may indeed be based upon real problems (including anxiety over using technology). Always check the basis of the complaint instead of dismissing it out of hand.

05]___Don't allow basic skill sets to atrophy because the technology now handles the job. Failures in the technology may necessitate the use of those skills. Assess what skills may be needed in the case of a failure in equipment or aspects of technology. Hold occasional "fire drills" to simulate problems and see how people handle them.

E]-Attend to the Psychosocial Components of the Task

01]__Perceptions of the subjective nature of work are related to accurate and inaccurate performance. Reductions in task related tension in terms of perceptions of mental demand, physical demand, temporal demand, concern for doing well, task frustration and effort are associated with

increases in error. Such things are more likely to occur when shifts in work rhythms from high to low occur, during lulls in work, and after breaks. The need to "warm-up" to the task before fully engaging it is one practical application of this concept.

02]__Formal and informal reports of job dissatisfaction are taken seriously. When people are unhappy, declines in productivity and accurate performance have been noted in pharmacy and other occupations. Also, job dissatisfaction is a precursor to people leaving organizations and turnover produces its own problems with accuracy and safety. New people may not be a good as those leaving particularly in jobs where there is an existing shortage of trained and experienced personnel. In some cases, you may be hiring someone else's problem and former employers may not tell you. In effect their gain becomes your loss since patient safety and accuracy can be adversely affected.

II: Physical Environment

01]___ Insure that sensory components of the environment are sufficient to conduct work that must be completed. People should be able to see, hear, touch and feel what they need to do their jobs.

02]___ Look "within reason" for ways to provide a comfortable, warm, and inviting work environment. A harsh institutional look to a workspace can have effects on the mental attitudes as well as the performance of employees. People should not feel like "commodities" stacked in spaces in the workplace. Personalizing the workspace and making it inviting contributes in a positive way to morale.

03]___Pay attention to objective as well as "subjective" impressions of light, noise, environmental distractions, crowding, space and other features of the physical space. Both are related to error and job satisfaction.

04]___Reduce or eliminate sources of distractions and noise that are affecting the concentration and attention of people.

05]___ Identify components of the physical environment that make equipment and technology difficult to use. Included here are such things as heat, humidity, poor lighting, power surges, dust, noise, and distracting sounds.

06]___Conduct a quarterly audit of the physical environment for problems noted above and the effects of any changes that were made to manage them.

07]___ Allow people to personalize their workspace with items that may have sentimental value or that add a "human touch" to the environment. People appreciate the opportunity to add some personal items that enhances their comfort with the space and satisfaction working in it.

08]____Temperature and humidity are comfortable for pharmacy personnel and conform to drug storage requirements.

09]____The physical layout of the pharmacy minimizes distractions and interruptions for pharmacists during a final check of work completed.

10]____ Workspaces where medications are prepared are clean, orderly, not crowded, and free of clutter.

III: Personal Qualities

A]-Enhance the Ability of People to Attend to Critical Task Events

01]___ Use principles for capturing and focusing attention on important details such as repetition, size, shape, color, contrast, to improve the capacity of people to pay attention to critical elements in labels, packaging and nomenclature.

02]___Take steps to insure that labels and packaging and other important information related to the use of medications by professionals and patients are ***visible***, ***readable***, ***understandable***, and ***can be discriminated*** from other similar things. Everyone needs to know what they have in their hands, what it is used for, and that it is the correct medication or instruction.

03]___Medication related information should be a more prominent feature on a label or package than the name of the manufacturer.

04]___ Use auditory, visual, and tactile information when adding cues to help people discriminate among medication labels, packaging or products.

05]___ Attending to two or more things at the same time is easier to do so if the information from each event is not originating from the same sensory channel. Cross-modal information (e.g., one sensory input and one auditory input) is easier to attend to than two visual or two auditory inputs. Thus, a user modification to a product container or medication vial might make use of visual and tactile information channels.

06]___ Attend to the following principles when trying to increase the visual sensitivity of information:

Contrast Sensitivity- Foreground & Background Discrimination

a. Pay attention to the contrast sensitivity with visual displays. Use light and dark areas on labels carefully. Light areas in the background and dark lettering in the foreground. Avoid reverse contrast lettering or black backgrounds with raised black lettering or dark blue colored raised lettering or foregrounds. The latter are popular on some types of equipment but are difficult to discriminate as illumination levels drop and for people with visual acuity problems.

b. Thicker (**Bold print**) is more easily seen when the contrast between light background and dark foreground areas is high.

c. Contrast sensitivity is affected by background lighting. Check readability of any changes in labeling or packaging under various light conditions. Make sure it is readable under relatively poor lighting conditions as well as in good light.

d. While it may seem useful to make things visible in poor lighting, one might also ask the questions whether the lighting itself needs to be changed or modified.

Readability of Print

e. Fine print and very narrow stroke widths are not good choices

f. Red is a color that is not identified by the cones in the retina under conditions of low illumination. A similar point can be made about Red-Green combinations that may be a problem for people who are

color-blind. In particular, when contrast sensitivity is not high, difficulties in perceiving the latter combination of colors can be a problem.

g. Fonts that adhere to typical letter shapes like text in a book or magazine are more easily read because they are more familiar. Non-standard shapes are more difficult to read as is BLOCK LETTERING

h. UPPERCASE print is a better choice than lower case print and **bold prints** are better choices for single words. Or, UPPERCASE lettering is a good choice to highlight particular parts of a word, e.g., UPPERcase. Such lettering provides a wider visual angle (makes the word longer) and lower special frequency (each UPPERcase or **BOLD** letter or combination of letters has fewer alternating patterns of light and dark to cover a fixed amount of space.

Thus, the word;

BOLD subsumes the space occupied by the rectangle. That same space with normal text would have a higher spatial frequency because it would take more

letters to fill the same amount of space BOLDD. In effect the available space becomes crowded.

I. With multi-word text, UPPERCASE PRINT IS MORE DIFFICULT TO READ. Lower case print is easier to read with multi-word text or the use of combinations of Upper and Lower Case Print Also Will Help with the readability of multi-word text.

J. Size of type to emphasize critical information is a good ideas within the guidelines provided above. Again, make sure that labels and word changes are readable under the normal "non-optimal" conditions that sometimes arise on the job.

K. Use print and not cursive writing. Print is much easier to discriminate among individual letters and letter combinations.

l. Full words rather than abv. (abbreviations) should be used.

m. Three to four letters "chunked" together on alphanumeric displays with a gap between them are easier to read. ONE TWO FOUR

n. Poor illumination conditions are frequent causes of difficult to read text. Make sure illumination levels are adequate for people to read what they need to read.

07]___ Use the placement of prescriptions during any manual data-entry at eye level to aid ability to focus on important details. The same principle would apply to anything that one is asked to read. Reading critical information under less than optimal conditions is likely to produce problems. Most people have long-standing bad habits for how they hold information needing to be read.

08]___ Use alerts and prompts in ways that get people to pay attention to critical medications and instructions.

09]___Pay attention to the sensory needs of people. Provide adjustable volume telephone handsets, workspace lighting, and clarity in printed instructions. *A similar point can be made for patients.* They sometimes have hearing and visual problems and need special assistance. Pharmacy personnel need to be alert to this possibility and to take necessary actions. The default assumption is that others are "like me." It is better to assume that patients do not possess the same sensory capabilities.

10]____Conduct an audit to insure that people handling medications inside of and outside of the pharmacy are using personal visual and auditory aids prescribed for them. Such things are of little use "at home," "in briefcases," "in a desk drawer," or "on a holder hanging around one's neck like a necklace.

11]___ Use focused task lighting and magnification "as needed" to assist in reading important information. Such devices are needed more often as one progresses into a shift.

12]___ Remember that people differ in how detail oriented they are. Individual with a "big picture—field-dependent" cognitive style should have additional sensory cues to discriminate among similar products. For them, context gets in the way and they have a more difficult time "seeing the individual trees in a forest." Their more "detail oriented—field-independent" counterparts have an easier time with "picking the individual trees out of the forest. "

13]___ When adding cues to enhance discrimination, use the most difficult time on task as the frame of reference. Begin with "less optimal conditions." Don't use the beginning of a shift and a refreshed employee as the frame of reference for what should be done. Discriminations make under the latter conditions do not necessarily translate into those that would work when the "going gets tough."

14]___ Sometimes cues need to be eliminated because they hold the potential for errors to occur. A good place to start is with the use of abbreviations. It is better to spell-out than to abbreviate. Thus a list of prohibited abbreviations, e.g., u, qd, qod, D/c hs, chemo and other drug regimen acronyms, etc., need to be eliminated. Some workplaces have targeted "an abbreviation of the week" to eliminate. The culprits are publicized and staff are discouraged and not allowed to use them. The adage from the song "I've got to wash that "man right out of my hair," applies here. A concentrated effort is needed since many abbreviations are personal favorites of people and there is resistance to doing anything about them. This often takes an institutional commitment but pharmacy personnel can certainly avoid using them as well as reminding people that "spelling it out really helps me to do my job.

A similar point can be made about unacceptable ways of expressing doses, e.g., by volume or number of tablets instead of weight; using trailing zero's for whole number doses and not using leading zeros for doses less than one. Also, prescriptions need to have the full name of the drug a shortened version, e.g., HCL can be read as KCL.. It is better to spell out the drug name and pharmacy personnel need to at least

gently encourage physicians to do so and in some organizations such prescriptions are unacceptable and are not filled until corrected.

B]- Take Steps to Reduce Cognitive Overload on People

01]___ Encourage periodic physical exams for people engaged in critical high-risk tasks [airline model]. Not everyone has the physical stamina and capabilities to engage a critical and high-risk job regardless of whether or not technological aids are in place.

02.]___Limit or discourage people from working when they are physically ill or under psychological duress.

03]___Insure that personnel are "physically" and "psychologically" fit for the tasks that need to be completed.

04]___ Audit the "quality of the breaks" pharmacy personnel receive. ***Breaks are not an option.*** People make fewer mistakes and capture more errors when they assess their breaks as adequate to meet their needs. The absolute number of breaks or the amount of time on any one break is not the major issue.

05]___Fatigue due to overwork and a lack of rest reduces productivity and efficiency and is a contributor to error. ***Some experts suggest that chronic fatigue has a detrimental effect on performance equivalent to a blood alcohol level of .10.*** Fatigue must be taken seriously. Fatigued workers in high-risk areas of pharmacy are a hazard. Monitoring of workers for excessive fatigue is a good idea. An increase in the incidence of process errors (mistakes made and corrected) is one of the signs of fatigue and a general lack of rest.

06]___ Integrate technology designed to reduce cognitive load, and insist that it is used as it was designed to be employed (e.g., automated dispensing systems and their components).

07]___The information processing system of people can be overloaded with new information deemed critical and essential. A problem is the tendency to place too much information into the latter category. ***To capture attention to any messages, do the following:***

a. Provide medication error and patient safety information in context by using narrative or story telling.
b. Be selective in what is considered to be important information for people to have at any one moment in time. Think of the 80/20 rule. Focus on the 20% of the things producing 80% of the problems. Gradually increase what is added to the 20%.
c. Present information in a variety of sensory modes and do so in small doses.
d. Strive for "depth of information processing" rather than overloading the information processing system with more and more individual "bits of information."

08]___Improve the communication, conflict-management, and stress management skills of personnel via on-site or off-site training. Up to a third of stress on the job is related to family and social-life concerns and the remaining from job related sources. Unmanaged stress and anxiety contributes to mental overload and a degradation in performance by

creating "tunnel vision," "speeding up information processing beyond the capacity of people to handle it," and creating adverse mental distractions that interfere with tasks.

09]___ Excessive overtime is a known precursor to human error. It is a source of overload on people in the workplace. Consider placing limitations on overtime or spacing the intervals between overtime shifts to help reduce negative effects.

10.]___ Rotation among tasks in a pharmacy is normally a good idea. This can occur both within a shift as well as between shifts. Sometimes it helps because the workload is spread around and individuals are not overloaded. On the other hand, people who tend to do the same task run the risk of becoming complacent and experiencing the effects of mental underload. The task is not interesting enough and their mind begins to drift to other things including non-task related issues. Such mental distractions are a source of error.

C]- Take Steps to Simplify and Standardize Mental Scripts for Actions

01]___Use checklists, have procedures in writing, use standard protocols, and keep critical information in easily accessible locations and readily available. In addition to making it clear exactly what actions should be taken, there is less demand on critical mental processes known to be problems such as short-term memory.

02]___Keep choices that people have as simple as possible but don't do so at the expense of patient safety. The fewer choices people have the less chance there is of error. While this point can apply to a number of areas it is certainly relevant to formulary decisions. The fewer the number of options, the less likely there is for medications to be misused.

IV: Interpersonal Factors

01]___ Help pharmacy task teams learn more effective ways to work together, to enhance communication, and to manage conflict in productive ways. Latter things reduce job stress, improve morale and team spirit, help to defuse issues that could interfere with patient safety.

02]___Instruct work teams on how to periodically "process" the way they work together, the positive and negative outcomes of their work, and to use that information to establish goals for enhancing team functioning.

03]___ Provide training on how to develop and run team meetings that identify issues in medication errors and patient safety in a non-defensive manner.

04]___ Have mechanisms in place so that people who have interpersonal issues at work or outside of the workplace can receive help.

05]___ Provide training in job related communication skills, conflict management, and ways to effectively work with others.

06]___ Make safe practices an individual and a normal part of interpersonal engagement. Safety programs in other industries for example often train people to call deviations from safe working practices to each other's attention. Thus, everyone is responsible for their own behavior as well as the actions of their co-workers.

07] ___Give all members of a pharmacy team the authority to stop an unsafe practice or procedure. The analogy here is to the team on an aircraft carrier responsible for launching an aircraft. Anyone on the line has the authority to stop a launch if an unsafe condition exists.

08]___ Train people in effective supervisory skills particularly those that provide people with the ability to mange in a positive and a participatory manner. Supervisors who can establish effective working relationships have people working for them who are more satisfied and productive and who report more errors and intercept more mistakes. One cause of this problem is a lack of training in supervisory skills. Thus people default to high control modes of working with others. Or, they simply have too many people to adequately supervise and use high control modes as a way to save time and "efficiently" work with others.

09]___Teach people how to work with supervisors. Effective supervisor-employee relationships work in both directions. The skills to make such relationships effective should not reside only in supervisors. Interpersonal skill training for both supervisors and supervisees is a desirable feature of organizations trying to become more competent in managing errors and accidents.

10]___ Look for ways to help people meet a variety of interpersonal needs that exist in the workplace. Individuals become frustrated on the job, dissatisfied, and mentally distracted when fundamental human needs in social interactions are blocked. Among them are the needs to be included and consulted on important decisions, to be allowed appropriate autonomy and influence over their jobs, and to be recognized and appropriately rewarded for their efforts.

11]___ Jobs always place a variety of psychological demands on people. To manage them well, they need a degree of control or decision latitude over the way they can deal with job demands. To do this they need autonomy to appropriately improvise when needed and discretion to exploit their skills on the job. Both are needed for people to develop their skills and to feel in control of what they do. Such things not only lead to job satisfaction but also to fewer psychological issues with their jobs and fewer illnesses and lost workdays.

V: Organizational Dynamics/System Dynamics

01]___ Discussions of safety related processes and procedures occur using methods that promote "quality decisions and outcomes" as well as "the acceptance of the outcomes by end-users." In effect, workplace changes of any kind demand that new ideas possess quality attributes and that they are acceptable to people. This ultimately means having broad based input to safety concerns from everyone affected, reactions to initial drafts of possible courses of action, and on-going evaluations of any safety related activities.

02]___Work to establish organizational norms that reduce medication errors and that encourage patient safety as a way of organizational life and not simply as an organizational priority. When asked the question, what's the first thing on your mind when you report to work, the answer should be "patient safety." A consistent message to this effect needs to be reinforced at all levels of the organization.

03]___ Red flag attempts within the organization to become efficient at the expense of reliability. Cutting corners is a safety hazard and those in charge need to be reminded in the strongest possible terms. Cutting corners is one of the ways that latent errors enter a system. When we hire cheap, purchase cheap, downsize and overload people, the seeds for error are sown.

04]___ Assess the extent to which anyone responsible for safety has the four critical organizational elements needed to do their job effectively. The elements are listed below:

a. "Clearly defined and sanctioned responsibility to do the job,"
b. "Authority over people to get their cooperation to do what is necessary,"
c. "Resources to do the job properly, i.e., time, energy, people, funding, equipment."
d. "Opportunity to do what is needed when it is needed."

People lacking any one of the above factors can experience difficulty in managing safety related issues. Discuss this problem upfront with those in the organization in a position to do something about it.

05]___Be alert to policies, procedures, and changes in tasks that may create a transfer of error from one domain to another. For example, while interventions such as new equipment and technology, workflow and workspace re-design, the "effective utilization" of staff, etc., have helped with "mechanical errors," the ***exposure*** to "intellectual" or judgment errors is likely to increase. This is particularly true when pharmacy personnel "freed of the routine aspects of dispensing" engage in additional patient contact activities such as medication counseling, disease management, and other tasks where a broader range of interpretations and decisions are made. At the very least, the exposure to such problems is likely to increase as it occurs more often involving more people.

A related issue is that not all pharmacy personnel are suited to such duties. They may not desire the contact or feel uncomfortable doing such tasks. Finally, those individuals (e.g., technicians) who are taking over the more "routine" parts of the pharmacy tasks may present problems of their own. Inadequate training, low interest in the tasks, and becoming bored with routine work can lead to problems.

06]___ Initiate broad- based training in root cause and failure mode and effects analysis. These are useful devices within an organization not only to assist with understanding errors and preventing them from occurring.

07]___Make the outcomes of root cause and failure mode analyses available to all relevant personnel. Model an open climate with regard to sharing information about mistakes and how to manage them.

08]___ Establish clear guidelines upon the discharge of patients so they have the correct medications and instructions they need.

09]___ Involve people affected by decisions regarding changes in policies and procedures to correct medication error and to improve patient safety in any discussions of the problem.

10]___ Use standardized tools such as the ISMP Medication Safety Self-Assessment to identify problems that need to be addressed in a system to reduce errors.

11]___Insure that key organizational personnel (i.e., visible, high status, opinion leaders) are placed on medication error and patient safety committees.

12]___ "Fix the problem and not the blame." Encourage and reinforce the use of non-blame and non-punitive reporting systems.

13]___ Encourage and reinforce non-blame and non-punitive approaches to problems *in all areas of the organization*. People watch how everyone is treated to decide how they will be treated. Thus, it's difficult to isolate a non-punitive and non-blame environment in only one part of the organization.

14]___ Organizational systems, if left to their own devices, will self-organize and not always in line with effective and productive ways of doing things unless interventions are put in place to help them do so.

15]___ Develop and use an in-house error reporting system. Identify barriers to using the system and treat those barriers as factors that adversely affect patient safety. Such barriers are more than challenges to overcome, they are precursors to more serious problems. In effect, they become a latent source of error in the system. Find ways to share what you have learned about errors with other organizations through anonymous reporting of quality related events and lessons learned. Use the national reporting systems in conjunction with your own in-house system to both report and to identify issues that would be of importance to you.

16]___ Encourage "follow-up" on safety related information, directives, and instructions. Alert people in the organization to the problem that safety information disseminated is not necessarily safety information received or utilized. People need to conscious attend to and to take actions related to safety related information for it to be effective. Getting the information out is only the beginning of the job that must be accomplished.

17]___ Model "follow-up" in the things you do on safety related issues. Remind others you asked to take particular actions or to share information to in turn "follow-up" with people they may have spoken to or to whom they gave information and instructions.

VI: Extra-Organizational Factors

01]___ Pay attention to sources of stress and mental distractions from outside factors that interfere with performance [e.g., broader cultural issues, Board of Pharmacy requirements, Joint Commission requirements, risk management requirements dictated by outside insurers, legislative mandates, etc.] . Stress from factors in the latter area tends to interfere with the ability of people to intercept errors and are associated with job dissatisfaction.

02]___Identify the time, energy, and resource requirements of demands on the time and energy of people that originate outside of the organization. Determine whether they facilitate or interfere with the management of medication errors and patient safety.

03]___ Determine whether people in critical jobs involving medication preparation, dispensing, and delivery are overly involved in demands from outside factors that interfere with their ability to do their jobs? People need some protection since such activities increase stress levels and mental distractions that may interfere with accuracy. Ways to do this include rotating those responsible for meeting such demands. Do norms, rules, and precedents for doing such things exist in your organization? Would they be helpful if they did exist? If so, initiate discussions on this issue.

04]___ Pharmacy personnel take time to understand cultural issues that are important to their patients. Everyone is not the same in what they expect of a healthcare provider and the ease with which they will share information or discuss a medical condition with them. This barrier is even harder to overcome if a pharmacist or pharmacy technician does not understand the language or the pharmacy does not have personnel who understand the language and customs of the people involved.
