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## **Labeling of Drug Vial Ferrules and Cap Overseals: A White Paper**

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## **Introduction**

This white paper represents a summary of three phases of human factors research activities, coupled with a detailed analysis of the USP proposal (revised November 2009) for the labeling on drug vial ferrules and cap overseals. The USP proposal seeks to limit the labeling statements on ferrules and cap overseals in an effort to make serious (i.e., “critical for the presentation of imminent life-threatening situations”) cautionary statements more salient. If no cautionary statement, as defined above, is necessary, the top surfaces of the Ferrules and caps must remain blank (*Pharmacopeial Forum, Vol. 36(1) [Jan.-Feb.2010]*).

The three phases included: 1) a human factors literature review, 2) a health care provider survey and 3) a human factors research study using health care professionals. In addition, we corresponded with the FDA and USP on this issue (to identify cap labeling-related incidents and scientific data on the issue) and posted requests for information and research on professional human factors and health care Web forums. Our objective across the three phases of research was to analyze known human factors research, guidelines and best practices as they pertain to the proposal and to collect human factors scientific data related to the proposal and its underlying premises.

## **Disclosures**

The research reported in this paper was funded by the Consortium for the Advancement of Patient Safety (CAPS) (<http://www.caps-edu.org/>). Prior to this analysis, I have had no involvement in the development of ferrule or cap overseal labeling, nor did I have any pre-disposition or bias on the specific issues of the proposal. I do not benefit in any way from the USP proposal being adopted, modified or dismissed. While my company performed various human factors research activities in an unbiased manner, this summary is focused on presenting theory, data, guidelines and information that potentially refutes or contradicts the USP proposal.

With any human factors analysis of a medical device or health care procedure, it is assumed that there is some merit in the proposed design. The focus, therefore, is to identify potential risks that might suggest that the proposed design will cause more harm than good or produce unintended negative safety consequences. Indeed, when validating a medical device design for FDA approval, the primary focus is always on identifying and mitigating risks under plausible worst-case scenarios.

## **The USP Proposal**

*Pharmacopeial Forum*

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### **Labeling on Ferrules and Cap Overseals**

Busy health care practitioners using injectable products must be able to easily see and act on labeling statements that convey important safety messages critical for the prevention of imminent life-threatening situations. These cautionary labeling statements must be simple, concise and devoid of nonessential information. Products that do not require such statements should be clearly differentiated so that those with cautionary statements are immediately apparent. Accomplishing this requires a systematic approach to labeling of injectable products, and one that assures that the ferrule and cap overseal—an area of these products that is highly visible to practitioners as they use these medicines—is reserved for critical safety messages.

Accordingly:

1. Only cautionary statements may appear on the top (circle) surface of the ferrule and/or cap overseal of a vial containing an injectable product. A cautionary statement is one intended to prevent an imminent life-threatening situation and may include instructional statements that provide potency or other safety-related instructions if warranted. Examples of such statements include but are not limited to: “Warning—Paralyzing Agent” and “Dilute Before Using.” The cautionary statement should be printed in a contrasting color and clearly visible under ordinary conditions of use. The

cautionary statement should appear on both the ferrule and cap but may appear solely on the ferrule if the cap overseal is transparent and the cautionary statement beneath the cap is readily legible.

2. If no cautionary statement is necessary, the top surface of the ferrule and cap overseal must remain blank.
3. Other statements or features including, but not limited to, identifying numbers or letters, such as code numbers, lot numbers, company names, logos or product names, etc., may appear on the side (skirt) surface of the ferrule on vials containing injectable products but not on the top (circle) surface of the ferrule or cap overseal. The appearance of such statements or features on the skirt surface of the ferrule should not detract from, or interfere with, the cautionary statement on the top surface.~USP34

### **A Use Case Analysis of the Proposal**

Today, only a minority of drug vials have messages printed on the ferrule or cap overseal. When a message does exist, it is usually limited to one topic (e.g., “Must Dilute”). In fact, I have not yet seen a ferrule or cap overseal with more than one phrase (“store frozen”) or two terms. Further, the USP has not pointed out specific ferrules or cap overseals that are over-crowded or cluttered. Nor have they cited any data to suggest that there have been medication errors due to “clutter” of messages on the ferrule or cap overseal. Clutter is a relevant term. It refers to presence of many irrelevant elements in the context of a user needing fewer relevant elements for a particular task. Given that vial ferrules and cap overseals contain little space for multiple information elements, invoking the concept of clutter is not applicable. Hence the issue of clutter or overcrowding, which has been identified as relevant to the main drug vial label, is not relevant to the small ferrule and cap overseal surfaces. Yet, a recent online article on the topic cites clutter as a driving force behind the USP proposal (Horowitz, Alan, “Ferrules And Cap Overseals: A Battleground,” *Life Science Leader*, April 2010, [http://www.lifescienceleader.com/index.php?option=com\\_jambozine&layout=article&view=page&aid=4010](http://www.lifescienceleader.com/index.php?option=com_jambozine&layout=article&view=page&aid=4010)).

Perhaps a more troubling premise of the proposal is the intended effect of prohibiting most cap messages while allowing only cautionary statements relating to imminent life-threatening situations. As presented in the proposal, and iterated in the aforementioned article, the main use case assumed by the USP is where a health care provider views a sea of drug vials and benefits from a heightened awareness of the few that have cautionary statements. As stated by Matthew Grissinger, director of error-reporting programs at the Institute for Safe Medical Practices, “A healthcare practitioner who opens a drawer filled with vials and their cap overseals is apt to notice those with imminent life-threatening warnings if the remaining cap overseals are blank, or so the thinking goes.” (*Life Science Leader*, April 2010, [http://www.lifescienceleader.com/index.php?option=com\\_jambozine&layout=article&view=page&aid=4010](http://www.lifescienceleader.com/index.php?option=com_jambozine&layout=article&view=page&aid=4010))

There are several critical flaws in this assumption, critical to any analysis of the USP Proposal. First, many health care providers who handle drugs do not open drawers filled with a vast amount of drug vials. This use case is NOT a common one. For example, a pharmacy assistant may be opening boxes and storing drugs in various places (shelves, refrigerator, freezer); a nurse may hand a vial to the anesthesiologist for purposes of giving an injection to the patient; a floor nurse may pull a single vial out of a drawer in a drug cart; or a physician may obtain a drug from a shelf in a drug closet. Second, independent of the context in which a health care provider obtains one or more drug vials, their task is always the same—first and foremost to obtain a specific drug with specific attributes. It is never the case where the task is purely to notice some drugs have cautionary warnings and other don’t. The task is always to find a specific drug x in concentration y, amongst other attributes.



*Image of sample drug vials representing USP proposal. Only caps with the label “paralyzing agent” are presented. All others are blank.*

Thus, the premise that the drugs with cap labels will stand out AND be relevant toward the selection of drugs is not supported by conventional practice. After all, once a pharmacist selects a drug vial from among many, or once a nurse obtains a drug vial from a specific drawer in a drug cart, the labeling of concern is now absolute with respect to that one vial. One has to ask: If, under the USP proposal, most vial ferrule and cap overseals are now blank, how are health care providers aided in selecting one those drug vials? Drugs are selected based first on their name—shown on the main vial label. If the proper drug name is identified, the health care provider then looks for other key attributes (volume, dose, concentration, etc.). Given this, there is no evident value gained from removing a reminder of one or two of these key attributes from the top surface of the ferrule or cap overseal.

In the article noted above, Marjorie Shaw Phillips, medication safety pharmacist at MCGHealth and a member of USP’s Safe Medication Use Expert Committee states, “Your mind plays a trick on you when you expect something. This is when we accept information that agrees with our hypothesis and reject information that does not; this is called confirmation bias. A busy health professional might think they are grabbing the right product based on size, shape, color, and a

vial being in the right place, when, in reality, what they are grabbing is different from what they expected.”

Here again, a stated premise of the USP proposal does not map to actual use cases or scientific knowledge. Since there are no current standards that limit the types of messages printed on the top surface of ferrules and cap overseals, there is no *a priori* expectation for the existence of a specific message in this area. Further, ferrule and cap overseal messages are fairly rare amongst all drug vials, so expectancy is somewhat low. Under the USP proposal, ferrule and cap overseal messages would become even rarer, to a point where most health care providers will not see any in a given day. This will further reduce the expectancy of such labels, rendering it unlikely (not more likely) that the few remaining cautionary statements are ever noticed. But more importantly, according to Phillips, confirmation bias may influence a health care provider to think they have selected the correct drug vial when in fact they have not. So, how could removing an extra and highly visible message that could point out that the wrong drug vial was selected be an improvement in patient safety? Noticing that you obtained the wrong drug or concentration after viewing the cap may be the only way to break someone out of their confirmation bias. Indeed, in our recent human factors study, one nurse initially selected a drug with a 100U potency thinking she had satisfied the task of obtaining the same drug with only a 10U potency. She noticed her mistake only upon placing the vial down on the simulated drug cart, where the cap label caught her attention. In a post-task interview she confirmed that, without the cap label, she would have confidently left the 100U vial as her chosen drug for that task.



*Drug vial with potency label on cap. This cap label prevented a medication selection error in our health care provider human factors study.*

Dr. Phillips adds, “There is no substitute for carefully reading labels, but without some kind of visual cue that looks different, we might not even realize we have not read the label thoroughly.” Ironically, this is a perfect argument FOR the value of ferrule and cap overseal labels. As one health care provider stated in our recent survey, “While certain persons may ignore all printed messages, I believe most health care personnel appreciate the extra precautions that the printed messages provide. In the fast-paced world of health care, any assistance to the providers is useful to slow us down and make us think before administration of any medication.”

Finally, another flaw in the USP proposal is that it assumes that what they define as “cautionary messages” can be determined *a priori* based solely on the volatility of the drug. In truth, even the most benign drug can be dangerous when given in the wrong dose, used in the wrong concentration, administered with the wrong method of input or is counterfeit. As one survey participant stated, “All medications should be considered dangerous drugs.”

### **Analyzing the Underlying Assumptions of the USP Proposal**

The following are assumptions underlying the USP proposal. This form of analysis allows one to better understand the various use cases that are applicable to the proposal as well as the potentially negative consequences.

- The proposal assumes that drug vials with blank overseals will be interpreted as having no critical safety implications related to the drug handling. What if a life threatening drug has no cap overseal warning? After all, the proposal is about limiting messages, not requiring them. Thus, it is very likely that health care providers will experience drug vials with no ferrule or cap overseal labeling, but have critical safety implications. This inconsistency will limit the main objectives of the USP proposal.

- The statement that “products that do not require such statements should be clearly differentiated” assumes that all labeling issues represent themselves in the context of multiple different drug vials viewed by the user in a given instance. What is the value of a user handling a single vial that is now devoid of any overseas labeling?
- The proposal assumes that all health care practitioners will have working knowledge of the new standard and therefore will have a heightened sensitivity to the presence of cap overseas labeling.
- The proposal assumes that information not considered cautionary, critical safety or imminent life-threatening is either not important for practitioners to notice or will be processed effectively even though such information is located only on the main vial label or package insert.
- The proposal does not address how a practitioner is aided once they have selected a given drug vial amongst a larger collection to interact with.
- The proposal assumes that the product name does not qualify as a safety critical or cautionary message.
- The proposal assumes that printing on the side surface of the ferrule can be done and is cost-effective.
- The proposal assumes that the new labeling guidelines will produce heightened attention to cautionary labels but does not address the potential drop in attention to drug vials absent any ferrule or cap overseas messages.
- If the percentage of drug vials with valid cautionary statements is higher than 40 percent, then the standard will not have value in producing a pop-out or salience effect. Plus, these effects are more pronounced and reliable when viewing a set of targets, not just one. Messages are more relevant to the use of a drug as opposed to its selection amongst other vials in a drug closet.
- If a company does not make a volatile drug but does have need to block counterfeiting or enforce cold chain management, they would be blocked from any labeling. How is a user of that drug vial benefitted from NO labeling on an area that is acknowledged as most salient to end users?

- If users often see vials with no cap overseal messages, they may, in fact, become less sensitive to labels when they do exist, or may explicitly reduce their attention to that area of the vial.

## **Results of Our Human Factors Efforts**

As noted above, we have conducted three phases of human factors research. Below is a brief summary of the findings of each phase.

### **Human Factors Literature Review**

We found no studies directly pertaining to drug vial ferrule or cap overseal labeling, and we were not provided any in our correspondence with the FDA and USP. This suggests a need for research on this topic, prior to changes in the standards that govern such labeling. What can be gleaned and applied from the literature on labeling, warnings, message design and medication errors suggests that the current approach is likely to be less effective in its key objective of making critical cautionary messages more salient to health care providers and, more importantly, is likely to introduce unintended negative consequences. The proposal bears on issues of expectancy theory, signal detection theory, salience coding, global vs. local process and information theory—all of which suggest that the proposal is not only flawed, but would likely introduce unintended negative consequences for patient safety.

Similarly, we found no medication error data that points to the ferrule or cap overseal as a source or cause of incidents or accidents, and we were not provided any such data in our correspondence with the FDA and USP.

### **Health Care Provider Survey**

We conducted the survey to gather objective and quantifiable data as to how ferrule and cap overseal labels are used and valued. In addition, we attempted to gather opinions directly aimed at USP proposal elements and assumptions. To achieve this objective, we targeted health

care providers who routinely handle drug vials (during receipt, storage and injection preparation or injection administration), such as registered nurses, physicians, anesthesiologists, physician assistants, medical assistants, pharmacists, CRNAs and pharmacy technicians. We conducted an initial survey that yielded approximately 300 responses. This survey was followed with a micro-survey in order to obtain clarification on three questions in the original survey that were deemed vague or poorly worded. This latter survey yielded approximately 250 responses, from both previous respondents and new respondents.

Collectively, it is fair to say that the survey data shows support for the general objective of the USP proposal, but not for the specific implementation plan for achieving this objective. Some key findings are listed below.

- Some of the messages that would likely be prohibited or restricted by the USP proposal were highly valued by the respondents. For example, many respondents cited the drug name, concentration, dose, expiration date and storage information as one of the most valuable purposes for ferrule/cap overseal labeling. Further, when asked to rate the value of certain categories of messages on ferrules and cap overseals the drug name/concentration were almost as highly rated as cautionary warnings, with 75% rating drug name/concentration as somewhat or very high value. In addition, dosage messages were rated by 54% as somewhat or very high value.
- In the follow-up survey, when presented with the idea of certain ferrule/cap overseal messages being prohibited (such as drug name, cold chain information, anti-counterfeit information), an overwhelming majority of respondents (74%) stated that “It would be harmful to eliminate most of these message.”
- In the follow-up survey, when presented with the idea of certain ferrule/cap overseal messages being prohibited, an overwhelming majority of respondents (80%) stated “Yes” to the question, “*Do you see the potential for increased medication errors due to the removal of messages related to dosing instructions, anti-counterfeiting measures, cold-chain storage, potency/concentration, population, etc.?*”

- No respondent cited a single example, or described a causal incident, where ferrule or cap overseal labeling was overcrowded.
- The majority of respondents stated that a prevalence of ferrule/cap overseal labeling would NOT lead to a decline in their perception of, or complacency with, ferrule and cap overseal labels.
- When asked which of two ways is the ideal method for making cautionary warnings more salient, the majority of respondents (69%) agreed with the statement, *“Present life-threatening messages in a unique color and with a unique symbol/icon, but allow other safety related messages to remain on the ferrules and cap overseals,”* while only 31% agreed with the statement, *“Eliminate all other, non-life threatening forms of messages from ferrules and cap overseals.”* The latter represented the USP proposal.



*Preferred approach among health care providers surveyed. Here, cap labels are allowed, but cautionary messages are uniquely coded with red caps.*

The collective responses of this health care provider survey demonstrate that the USP proposal does not appear to address the variability in users, contexts and needs that exists with respect to drug vial ferrule and cap overseas labeling. The data also suggest that a more detailed and sophisticated approach might be needed, one that perhaps holds the same objective of making the most critical cautionary warnings stand out amongst other less-critical messages, but uses different tactics in doing so.

### **Human Factors Study with Health Care Providers**

We conducted an empirical human factors study involving a variety of health care practitioners (nurses, physicians, pharmacists, pharma techs, medical assistants), all of whom normally handle drug vials and are responsible for cross-checking drugs against prescriptions and patient drug delivery orders.

The study consisted of 20 participants (8 males and 12 females) who were placed into one of two groups. Fifteen participants (Group 1) were not instructed about the cap labels or asked to explicitly use them. Five participants (Group 2) were explicitly instructed (briefly trained) to use the cap labels and to cross-check all vial labels with the cap labels before finalizing their selection of drugs for a given task.

Each participant performed a set of tasks centered on selecting the correct drug for a given Rx amongst a large set of drug vials. A total of eight drug selection tasks were used, each presented twice to each participant; once where the correct drug vial(s) had cap labels and once where the correct drug vials had no cap labels. This also included two drug storage sorting tasks, in which they were asked to organize/sort drugs by their cold storage requirements.

Based on the performance data and post-interaction interviews we can conclude the following:

- Health care providers are generally not used to viewing cap labels. Even in the presence of cap labels, many ignore them or do not see them and utilize the vial label solely. Further, they are often trained to check only the vial label.

- Participants of all health care types made many errors, with or without cap labels. Some of their errors would have disastrous consequences (e.g., selecting 100U potency instead of 10U). They exhibit common failures of memory, perception and attention. This demonstrates how difficult it is for humans to distinguish between drug vials that are very similar, even when explicitly tasked to do so in a study. Also, regardless of their failure rates, they are consistently overconfident that they obtained the correct drug vial. This finding actually supports the potential value for cap labels. If key attributes can be reinforced on the ferrule/cap, and health care providers were trained to cross-check via the cap label, we may see a reduction in medication errors.
- Related to point one above, some participants indicate they did not notice the many cap labels during the study, demonstrating how experience influences perception. Others indicated they did notice (and use) the cap labels. It varied from person to person (in the untrained group).
- When the cap labels were noticed and used, performance was better (the correct drug vial obtained) and faster, and ratings were more positive.
- When health care providers were trained to cross-check the vial label with the cap label, there was an increased benefit to drug selection accuracy and time.
- Post interviews made it clear that reducing the incidence of cap labels would actually further reduce the likelihood of a health care provider noticing ANY label that does exist (as per the USP proposal). The lack of cap label prevalence that exists today results in shaping pre-attentive perceptions that are stronger than the perception of information at the time of the task. In other words, when health care providers are not used to seeing or using cap labels (which would be even more rare under the USP proposal), they literally do not see (perceive) labels when they do exist. They are blinded to their presence.
- At the end of the session we presented each participant with three approaches to the future of ferrule/cap labeling:
  - **Option 1:** *any drug could have a label or not, and of any color/design (as is the case today).*

- **Option 2:** *only volatile drugs that could cause life-threatening harm would have cap labels and all other cap messages would be prohibited (USP proposal).*
- **Option 3:** *volatile drugs that could cause life-threatening harm would be uniquely coded in a special cap color (e.g., red) and perhaps with a special icon, but other drugs can still have cap labels, just not in the designated life-threatening color/design.*
- ALL BUT ONE participant selected **Option 3 (HF Principle) as the best.**
- Most indicate **Option 2 (USP) as the worst**, followed by Option 1.
- Most participants viewed removing the messages on caps as harmful (no participant stated it would be beneficial) and likely to increase medication errors.
- Finally, most of the participants indicated that cap labeling could be useful to improve patient safety if they were both more common and health care providers were explicitly trained to make use of them.

## Conclusions

I both understand and appreciate the objective of the USP proposal. There is merit in wanting the most serious cautionary statements to be most easily perceived, understood and acted upon by health care providers who handle drug vials. However, the proposed method is not the most effective way to achieve this objective, from a human factors perspective. More importantly, the present USP proposal is potentially fraught with serious negative “side effects.” Further, the USP proposal contradicts the current trend of providing additional redundant layers of protection in line with principles of resilience engineering. For example, layers of information have been added to, not subtracted from, vials containing the drug Heparin (see image below). As one survey participant stated, “I don't think there is such a thing as NON-ESSENTIAL information which acts as additional safety measure on any medications, injectable or other types.”



*Heparin drug vial with and without outer label wrap.*

In forming my opinions, I reviewed a large volume of research on this topic and found no studies directly pertaining to drug vial ferrule or cap overseal labeling. This alone suggests a need for research on this topic prior to changes in the standards that govern such labeling. What can be gleaned and applied from the literature on labeling, warnings, message design and medication errors suggests that the current approach is likely to be less effective in its key objective of making critical cautionary messages more salient to health care providers, and more importantly, is likely to introduce unintended and negative patient safety consequences.

In an era with a focus on patient safety and resilience engineering, we should be developing strategies and guidelines for adding and enhancing layers of protection against medication errors. We do not need fewer drug vial cap labels, we need better cap labels and new drug handling procedures that formally adopt cap labels as useful cross-check sources of information. Toward this end, we need a program of human factors research to guide drug manufacturers on how best to decide what information to print on a cap and how best to present this information. As President-Elect of the Human Factors and Ergonomics Society, I would welcome the opportunity to harness the knowledge and experience of those in my field toward this important issue. This is clearly a gap in knowledge at both the FDA and USP and represents a critical unmet need. In the absence of this guidance, the USP proposal can best be described as a flawed approach that lacks both patient safety data as its impetus and scientific data as its basis.



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## Talking Points

Below are 10 talking points based on my analysis of the USP proposal:

1. The USP proposal is NOT based on medication error data, incidents or accidents.
2. The USP proposal is NOT based on human factors data, theory or design principles.
3. The USP proposal is NOT mapped to common use cases. The proposed manipulation of drug vial cap labeling will not affect the majority of drug identification judgments made by health care providers and the context in which these judgments are typically made.
4. Our nationwide survey of health care providers indicated that the majority value ferrule and cap messages, including those that would be prohibited under the USP proposal. Many stated that this is an extra layer of information and patient safety protection.
5. Our first-of-its-kind study, using health care providers, showed an overwhelming benefit for the presence of cap labels. Collectively, across a variety of common drug selection tasks, participants were more accurate and faster when cap labels were present, then when they were not.
6. At the conclusion of each session of our study, we presented each participant with three different approaches to the future of ferrule/cap labeling. None of the 20 health care provider participants chose the USP proposal as the best approach; the majority chose it as the worst.



Rated as **worst** approach (equivalent of USP proposal)



Rated as **best** approach (A. Andre concept)

7. Nearly every day, health care providers make drug selection errors based on information presented on drug vial labels. The ferrule and cap overseal surfaces represent an underutilized area where specific messages can thwart confirmation bias and confirm uniquely identifying attributes, potentially reducing medication errors.
8. The USP should provide guidelines on how best to make use of cap messages to prevent medication errors. Do not restrict their general use as an important extra layer of information, but instead promote a better design and then make them a part of the habits and drug identification procedures of health care providers.
9. Guidelines for which attributes of the drug to reinforce on the highly visible cap overseal, and how to best present this information according to human factors guidelines, is what the industry needs as part of the patient safety and medication error reduction movement. This is the best approach to address any concerns about how labeling is currently approached.



## **Author Biography**

Anthony D. Andre, Ph.D., CPE is the Founding Principal of Interface Analysis Associates (aka Usernomics), a successful human factors, ergonomics and usability consulting firm located in the San Francisco Bay Area, California. Dr. Andre is an internationally known expert in situation awareness, user-centered design, medical systems design and usability testing. Dr. Andre, along with his staff, has evaluated, usability tested and designed over 400 products and human interface systems since 1993. He has consulted to numerous biotech, health care, drug and medical device organizations, including: 3M, Abbott Labs, Abbott Diabetes, Abbott Vascular, Acuson/Siemens, Amgen, a.p. pharma, Applied Biosystems, Bayer, Biogen Idec, Cardiac Science, Cardionet, CU Medical, Genentech-Roche, Hospira, Medquest, Novare Medical, Philips Medical, Radiant Medical, rpr Gencell, SpinX, Tandem Medical, Thoratec, Worldheart, the VA Administration and others.

His design of a complex bio-tech software application was voted the Best New Life Science Product in 2008. In 2009 he was the recipient of the User-Centered Design Award, given by the Human Factors and Ergonomics Society. Prior to establishing Interface Analysis, Dr. Andre was a Principal Scientist at NASA, where he headed the control/display evaluation laboratory and developed next-generation interfaces for aircraft cockpits and air traffic management systems.

For the past 17 years, Dr. Andre has served as an Adjunct Professor of Human Factors/Ergonomics at San Jose State University and is a founding member of the Human Factors/Ergonomics Graduate Program. He teaches courses on user interface design, usability testing, research methods and cognitive engineering. He was honored as the 2009 College of Engineering Lecturer of the Year.

Dr. Andre received his Ph.D. in Engineering Psychology from the University of Illinois. He is also a Certified Professional Ergonomist (CPE). Dr. Andre is currently the President-Elect of the Human Factors and Ergonomics Society, the world's largest society of Human Factors and Ergonomics professionals.

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