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Session: Integrating Dual Process Implications into Implementation of Cognitive Support Design in the Clinical Setting

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Molly: So I do want to go ahead and get us started now. So introducing our session today with opening comments, we have Dr. Matthew Samore. He’s the, pardon me, chief of the Division of Epidemiology in the Department of Internal Medicine and the director of Informatics, Decision Enhancement, and Analytic Sciences, known as the IDEAS Center, and that’s located at Salt Lake City VA. He also has adjunct appointments in the Department of Biomedical Informatics and the Department of Family and Preventative Medicine at the University of Utah.

We also have joining us Dr. Heidi Kramer. She’s a research associate, also at the Salt Lake City VA IDEAS Center of Innovation, and she’s also at the Department of Biomedical Informatics at the University of Utah.

And finally joining us, we have Dr. Charlene Weir. She’s an investigator at the IDEAS Center, and she’s also an associate director for education and evaluation in the Geriatric Research Education and Clinical Center, known as GRECC. And that’s at VA Salt Lake City health care system. She’s also an associate professor at the Department of Biomedical Informatics at the University of Utah School of Medicine. So I’d like to thank everyone for joining us today, and at this time, Dr. Samore, may I pass it over to you?

Dr. Matthew Samore: Okay, thank you very much.

Molly: Perfect, now just step into slide-show mode.

Dr. Matthew Samore: Okay, how does that look?

Molly: Thank you. Looks great.

Dr. Matthew Samore: Excellent. I want to thank everyone for joining. We hope this will be an interesting, stimulating presentation, and that you might have lots of questions, so we’ll get started. I’ll be just talking for a couple minutes before proceeding to Charlene Weir and Heidi Kramer. So thank you, Molly, for that introduction. It was very nice, very kind, and I’ll just move on to discussion of where this session fits in with these other sessions that we’ve had that are tied to a supplemental issue of the *Journal of Biomedical Informatics* that deals with the theme that is actually the focus of our Salt Lake CREATE, namely cognitive support for therapeutic decision-making. And so hopefully you’ll be able to stay-tuned for the session three, which is being given next Wednesday at the same time.

Now, Charlene and Heidi are presenting work that is tied to two of the papers in this supplemental issue, and these both address this issue of what we call bridging the attention gap. And both of these presentations will address the application of dual process theory, both for practice and for implementation, and for providing that theoretical and model-based approach to designing and implementing innovations. So you see a figure here of a person trying to lift very heavy barbells. This is supposed to be a graphic symbol of the kind of load that we manage in our daily lives, and we seek to control these cognitive resources, these attentional resources, you know, because they are in limited supply. Therefore, as humans we try to lower the cognitive load that we face in our daily tasks. Now, an example of this was visibly expressed by President Obama a few years ago when he was interviewed in *Vanity Fair* when he stated that he organized his day so as not to need to make any decisions about what to wear or what to eat; that he had too many other decisions to make. So in controlling his environment, he was limiting/lowering the cognitive load for things that were not important for his work. And this is what we do in health care, as well. And so we’re going to talk today about ways that we can lower cognitive load, either by improving learning or improving the automaticity of tasks, or by providing environmental cues that support task performance. And also another key technique for reducing load is to reduce interruptions.

So again, this hopefully these presentations will convince you that theory and models are practically useful, they also advance science and help us test hypotheses, they relate directly to implementation, implementation as a technique for inducing change has the impact or the effect of increasing load. And so what we tried to do when we designed and implement innovations effectively is deal with that increased load, that challenge of increased load, by using techniques that help bring it back to a more manageable level. And again, that’s what you’ll hear from Dr. Weir and, Drs. Weir and Kramer.

This supplement is available on this link that you see here, and the other articles that are in this supplement are listed here. And again, next week Wednesday you’ll hear a discussion of two more papers from this supplement. So with that, I’ll turn it over to Charlene.

Dr. Charlene Weir: Hello everyone. I’m Charlene Weir. I’m going to talk to you today a little bit about the relationship between dual process frameworks and implementation. I hope I can make the link clearly. So going onto the slide that has ‘crossing the quality chasm.’ When the Institute of Medicine published this book, it resulted in increased focus on work process in implementation and behavior change, and I think that’s the focus of here today is how to make the links between that and, sort of, some of these cognitive theories. Next slide please.

I’d like to know, we have a poll question. I’d like to know what everybody’s role is?

Molly: Thank you. So for our attendees, we’d like to get an idea of what your primary role is in VA. We understand that you may wear many different hats within the organization, but we’d like to understand your primary role. If you do not see your exact title on this slide, please wait until the end of the session where I put up the feedback survey that will have more extensive listed titles, and you might find yours there to select. Looks like we’ve got a nice responsive audience; two-thirds have already replied, and I see a pretty clear trend, so I’m going to go ahead and close this out now and share those results. So as you can see on your screen, 8% responded student, trainee, or fellow; 8% responded clinician; 38% responded researcher; 20% administrator, manager, or policy-maker; and 28% selected other. So thank you again to our respondents, and we’re on the next slide.

Dr. Charlene Weir: Yeah, so now we’ll start into the particular study for which we’re presenting today, and here’s an outline of what we’re going to talk about. And the first thing we’re going to do is talk about how dual process and the regulation between these different memory processes impact change over time. We’re also going to talk about self-efficacy, what that means in terms of behavior; the relationship between perceptions of self-efficacy and behavior, because one of the goals of this talk is to highlight the importance of focusing on behavior in terms of measuring outcomes. We’re also going to interweave QI processes into this discussion briefly. Most of you are aware of the foundational aspects of QI, but it has occurred to me many times that the tools, message, and philosophy of QI are completely in congruence with dual process framework. And then we’ll go onto the study itself, aims and objectives, methods, results, et cetera.

So, memory, this is next slide. Most of you may have some familiarity with this. Kahneman actually published a book called *Thinking, Fast and Slow* that popularized the work of about a hundred years actually of research. But I think it’s worthwhile reviewing here. We can talk about memory and mental representation as basically having two processes: we have an automatic one they call Social 1, and another active one that requires attention that’s called System 2. So the first one is System 1, and the second one is System 2. The key thing about these two different systems is that System 1 is the big one; there’s been a lot of visuals on the internet about this with a picture of an elephant with a small rider. So the elephant is System 1, and the knowledge that it grows overtime is associative. Everything that we see, feel, hear, and interact with is sort of recorded, basically, and we don’t have to be aware of that recording at all for it to happen and the associative links could be make. And so there’s a lot of things in there that we feel every day that are very common emotions; social interactions that end up what we call System 1 processes. System 2 is symbolic/active reasoning, and it requires a lot of attention. So in System 1, you learn very slowly, and this is important for our purposes today is that learning takes a long time; you have to change the linkages between memories, structures. System 2 you can learn rapidly because it makes the links rapidly. You could forget it faster, too, but it requires a lot of attention to do so. And just for those who aren’t cognitive psychologists, the memory system is a set of acquisition, retention, retrieval mechanisms, and it’s a bit physiologically-structured. And why do we do it? Well, probably because we need our big, slow brain in order to, you know, learn over time, but we needed this extra fast brain to learn rapidly and to regulate the slow one. So we’re going to be talking about that more.

Now, in terms of dual process and change, what we want to find out, one of the things that the implementation world hasn’t focused on too much is what cognitively is happening when you implement a CDS, and that is something that I am hoping that we can address today. Next slide to the need for understanding mechanisms.

So it’s one thing to implement something and measure the outcome. It’s another thing to actually understand why. So RAND produced a systematic review of health information technology interventions, and noted that even though they had randomized trials and some measure of effect, they really had no generalizable knowledge, because generalizable knowledge comes about through understanding the mechanisms. And that’s what theory does for you. And in their case, they were focusing on implementation processes and the cognitive impact.

So on the next slide, we’re talking about CDS implementation and change, and dual process theories. And here, this is, the main point of this presentation today is that implementation strategies have to address both of our memory systems. They have to capture our attention because work is generally automatic, and we’re not going to change unless we pay attention to things. But because we are cognitive misers, it’s going to take a lot of effort, so the only way to minimize effort is to increase knowledge and maybe enhance motivation. Eventually, we want to go back to a automatic process where behavior is captured through automatic pattern matching and cueing in the environment because that minimizes cognitive load, and the result is new habits. So you can see that it’s a bit complex for going from automatic to System 1 to System 2 where we have to pay conscious attention, back to System 1.

So we have another poll question here, poll question number two.

Molly: Thank you. So for our attendees, you do have the second poll question up on your screen: which best describes your experience in designing and implementing computerized interventions? Answer options: have not done any; have collaborated on some projects; have led projects myself; have applied for research funding in this area; or have led a funding research grant in this area. And it looks like people are a little bit slower to respond, and that’s perfectly fine; take your time. Okay, it looks like we’ve capped off right around 75% response rate, so I’m going to go ahead and close that and share those results: 35% have not done any; 26% have collaborated on some projects; 35% have led projects themselves; and 2% have applied for research funding in this area; 2% have led a funded research grant in this area. So thank you to our respondents.

Dr. Charlene Weir: Thank you, that’s good information because the information presented in the talks should be very applicable to those people who are actually in the ground, on the floors actually making change happen. So the next slide talks about the PARiHS framework, and the reason I’m putting it up here is it’s a very common and well-accepted implementation framework in the VA, and it has solid empirical evidence supporting it. Basically has three components: evidence, context, and facilitation. And notice how well these might map on to a, the dual process perceptions evidence is that it means that participants believe in the efficacy and effectiveness. And in other words they have to have the knowledge structures to actually even move forward. There has to be supportive leadership, both on the floor and in the culture, and that means that there’s social support. And then facilitation consists of all of the small levels of activities that are done to link behavior to environmental cues, and to facilitate change. So you can see here how I mapped them out. Evidence is System 2 attention, so if somebody tells you, you [unintelligible 16:26] next slide is quality improvement and facilitative processes, so evidence can move to System 2. Evidence means that it will require us to pay attention; something has changed, new evidence, new research. We have to change what’s happening. Context provides motivation; you have incentives by your organization, by the people you work with. And facilitation, as I said, brings control of behavior under environmental cues.

And so kind of to sum up this whole arena, the next slide: that change is both a cognitive and behavioral event, so that’s the next slide, oh yeah, and so it’s not enough just to value something. It’s not enough to know what to do. It’s not enough to even have everyone agree that it’s the right thing to do. And finally, it’s not even enough to have resources in order to make behavior happen. Eventually, the actual behavior has to become embedded into the context and environment, and become mostly automatic in order to maintain change over time. And the result of that is it minimizes cognitive resource and effort.

So let’s go to the study itself, now: care of the older adult. This study was part of a larger Reynolds Grant that was submitted to, where Mark Supiano was the PI, and the focus was on improving care of older adults in community settings. And the need for that is well-documented. You can see here the rates and most of all of the recommendation care for vulnerable elderly. And so the question is, how can we improve that care? And it’s easy to see why it’s difficult because older adults, especially vulnerable older adults, have lots of comorbidities, lots of things to worry about, so there’s a lot of competing attention and it’s hard to, you know, sort things out to automatically pursue certain behaviors.

So this slide right here on QI techniques and self-efficacy, next slide, is talking about how [inaudible 18:46 to 18:52] measure change is because it’s very close to the behavior itself. When you do a measure of self-efficacy, you’re saying ‘I can do this behavior.’ And [inaudible 19:02 to 19:16] [unintelligible 19:16] time. Now that I’ve talked about the program a little bit, there’s a little bit of likely disorder in slides, so I’m going to have Molly move ahead to a slide in a minute, but so the program description’s called Age QI. It was a 6-month geriatric intervention across three large health care delivery systems in our local area. There were 33 clinics, they all chose their own topic, and so in order to enhance the desired change, the implementation group which I was part of, would go to the site. We’d have a 2-hour introductory didactic session kickoff, everybody would decide on their topic and plan things, plan what they were going to do. We designed the computerized support that they needed that was tailored to the guidelines or alert that they needed, and then we conducted facilitation activities for six months and kept a log book on that. We also provide them monthly feedback on their performance and did the data analysis for them. And for motivational purposes, we gave CME.

Now, in order to measure self-efficacy, the key thing to effective measurement is to focus exactly on the behavior of concern. We used Bandura’s rules for assessing self-efficacy, which means that you specifically address the behavior of interest, and you can see here in the slide on measuring self-efficacy where we have making an accurate assessment of older adults with depression. So we had these three questions here are about depression, and for each of the clinical domains of interest we had these three questions, and they basically essentially measured perceptions of self-efficacy.

So moving onto the next slide, which is the results. Now, I apologize. The slides are just slightly out-of-order here, but we gave, there were 149 ordering providers and PA’s and physicians; most of them were physicians. And we gave a pre-self-efficacy measurement and a post-self-efficacy measurement on all of these six domains, pre-and-post. So those who filled out all forms, pre-and-post, were 49 physicians and you can see here that the scores, pre-and-post their means on the items, the means have to do with adding of different items, but you can see the significance was at close to the .05 level for everything except for dementia. But the story is more fine-tuned when we go to particular topics that they were interested in, and this is what’s important here is that they reported greater, oh, we’ve moved to the next slide, so here what we did was measure pre/post self-efficacy ratings on their own topics as compared to their not topics. In other words if you were focusing on fall prevention, which were some of the VA and community clinics, you had much higher increase in self-efficacy regarding falls as compared to all of the other domains. Similarly with advanced directives, and similarly with all the other topics. So the point here is that by targeting the QI experience increases self-efficacy on that topic alone and not necessarily across the board.

So going to setting/participation, this is the next slide, the only reason I’m showing this is that it illustrates who we were focusing on. We have three different health care clinics: university, VA, and other, and we had high participation rates of the clinics. And of the 134 providers that were involved, 49 completed the forms.

So next slide continues on with the results. The other important piece of result is that all the clinics, all 33 clinics that we were focusing on had a significant increase in patient outcomes for their screening or their care processes. Some of them larger than others, but the QI process was quite successful. And you can see the numbers here. There was, advanced directives for example went up to 100% in a VA clinic that we were focusing on. And falls, university, all their clinics went up to 46% for falls screening. So it was a good effect; not perfect but pretty good results. The other primary question here is, does facilitation, which actually focuses on the minute barriers, the specific incentives, the actual concerns of the people who are implementing a project, did that have any impact on their self-efficacy, and internally, and on their success? So you can see we had a question: As a clinic, we received adequate support from the University AGE QI staff. That question was very highly correlated, .58 with the estimates of proficiency at geriatric assessment, particularly at general overall self-efficacy of caring for older adults. That was a correlation of .66, and also interestingly enough, there was a significant increase at self-efficacy for implementing QI projects. So you can see that there was the physicians experienced an increased sense of control and confidence in engaging in these kinds of activities.

So for implementations and conclusions, the QI framework, the QI philosophy actually was very effective at changing the behavior of the clinicians and the self-efficacy change was a mechanism by which that happened. And facilitation strategies were associated with those self-efficacy changes. And then by moving from habitual behavior to focusing attention on the behavior, providing behavioral cues, increasing their skills, they were allowed to maximize automaticity, minimize cognitive load, and make the behavior change of interest.

So there are certain limitations. Facilitation was not standardized. Frankly I don’t think that’s a limitation, because everything was tailored to the clinic itself, but some clinics had a lot of facilitation, and some that didn’t have so much. The sample size is limited, limits our ability to do a real mediation analysis, which would have been desirable, and the behavior itself was not individually assessed. In other words, we assessed the clinic but not the specific behavior of the individual physicians. We assessed their individual self-efficacy ratings. And of course, it’s geographically limited because it was only in Utah, a wonderful state by the way. So I think that concludes our presentation.

Molly: Thank you, Dr. Weir. I do believe we had a question from Dr. Samore before we move on to Dr. Kramer’s portion. Dr. Samore, are you on?

Dr. Matthew Samore: Sure, thank you. This was something that I intended to mention in my introduction, but really would love to hear you just comment maybe for just a minute or two, Charlene, about the relevance of the dual process theory, this model of implementation that you’re describing, the relevance for the VA priority of modernization, particularly as it relates to the adoption of new EHR. Can you just briefly share some of your wisdom about that?

Dr. Charlene Weir: That’s an interesting question because I actually was in charge of the project manage for implementing CPRS in our local VA as we move from paper to the Electronic Medical Record. So I experienced a lot of that, kind of, change. Now people are using it, you know, every day. It’s completely imbedded in practice, and I have to say it’s probably pretty automatic. Even if you put in time-saving changes and stuff, sometimes people don’t like to take the effort of learning the new time-saving change. So making that change to a new EHR is probably going to be quite a slow process in a way, not just because they are developing something new, but because people who are very busy have to change their tools, and it’s going to take a lot of cognitive load to do that. But, issue is practice enhancing self-efficacy, enhancing skill-sets, and I think that would be the way to improve the implementation process in that case. Did that answer your question?

Dr. Matthew Samore: It sure did. That was great, and I know that probably should be another topic on another seminar, Cyberseminar.

Dr. Charlene Weir: Yeah, it’s always amazing how long it takes people to adopt new changes in their life, especially things like computers and the tools that they use, because tools should be out of their minds. They don’t want to even think about the tools. Any other questions?

Molly: No, not at this time. I think we can turn it over to Dr. Kramer. Thank you.

Dr. Heidi Kramer: [inaudible/unintelligible 29:17 to 29:23] if that’s going to work for you, Molly.

Molly: You’re coming through just fine.

Dr. Heidi Kramer: Okay, thanks. Alright, thank you. Thank you, Charlene. I think that was a great introduction for interventions to support dual processing and [inaudible 29:40 to 29:43] my presentation today is going to be on literature review that we did, that we do a systematics review of electronic checklist in health care, and an outline of today’s discussion is that, I’m going to talk about what is a checklist, and why would you want to use one? And an overview of the four types of checklists, and then talk about why we use checklists, why we look to checklist use in health care, and how we searched for checklist use, and what we found. And I want to wrap-up with some possibilities for improving checklist use in health care.

So if we go forward to the next slide, we talk about everyone seems to start discussions of checklist use, with the examples of aviation safety, and I’ve seen papers where people say, ‘I am sick of the comparison with aviation’, but you know, they start out with ‘wouldn’t it be great if aviation-type checklists could be used in health care to reduce errors and improve care.’ And early checklists used in health care did result in positive outcomes such as reduced complications, reduced surgical site infections and mortality. However, some checklist implementations have resulted in disappointment. And URBACT reported in 2014 that after examining surgical safety checklist use across several acute care hospitals in Ontario, Canada none of the targeted surgical outcomes improved. So the overriding question is, how to ensure checklists meet their potential.

And so let’s talk for a minute about what checklists are good for, and when. And checklists aim to support, improve, or change the operator’s cognitive processes to increase the levels of control for successful operation of the system. So in other words, to switch to more of a System 2, to have people sink more deeply, it’s intended to help operators focus on the current task, which brings behavior under immediate environmental control, and minimizing mindless behavior and decisions. And so by generalizing the conditions that allow for increased levels of control, the outcomes are more predictable, can be reliably reproduced with different operators, despite their individual and collective cognitive weaknesses. And we all have weaknesses such as, you know, working memory; what am I doing, what I am supposed to do next? And we all know checklists are intended to reduce cognitive loads, they actually increase the cognitive load if the checklist interrupts, or delays, or interferes with the operator task. Or even, in some cases, to lull the operator into treating the task mindlessly, in direct opposition to what the intent is.

So the checklist can be used as decision and memory aids through all stages of task completion. Now in planned formation, in the storage and in the execution.

And checklists, the next slide, the checklist can be used as decision aids. During planned formation, they act as decision aids. So when you’re making a decision, all the relevant criteria can be specified and prioritized to minimize your cognitive biases, such as availability or familiarity, because just what comes immediately to mind may not be the best option, and because an action is the normal behavior, it may not be the optimal behavior. So checklists can also provide data on what to consider in the plan. And next slide.

Checklists are memory aids, so in addition, they can help us keep track of our progress. And a sequential checklist can help the operator know the correct steps for task completion.

I want to talk about, next slide, I want to talk about the types of checklists, and let’s spend some time on this because there are different types of checklists, and it’s important that when we as researchers, or we as clinicians, select and want to implement a check list, we need to know what kind of checklist that we want to use. There is essentially four different kinds. The unstructured laundry list, which is your grocery list type thing. The order doesn’t matter, the steps doesn’t affect the performance, and a checklist doesn’t have to be a list of questions with a check box to it. The empty spaces next to specific vital signs serves as a checklist, and as a memory aid to remind clinicians to collect and assess vital signs comprehensively. Another kind of checklist is the criteria of merit, or the COM list. It includes a rating and a ranking of all the attributes to evaluate. It’s similar to a laundry list in that the completion or assessment of the order may not be important. However, the items may differ in their priority. You know, our typical example of this is like a cook-off or something, but they help you make objective judgements so you don’t get so much of a halo-effect: I like the sales person so therefore I’m going to buy this piece of equipment. But you can list the relevant criteria, the speed, the precision, the price. And then rate and rank each option and make a comparison decision. And also, it could be used in diagnoses if some criteria is more prevalent, more important, more unique, then you’d want to consider that independently. So a sequential checklist is just like what it sounds. It’s a checklist where the order of the task matters, and it serves as a memory aid to direct your attention to one aspect or another. And aviation checklists are the [unintelligible 35:42] of the sequential checklist. And next is the flowchart, and a lot of people don’t think of flowcharts as a checklist, but they’re defined by the steps of a task that include decision points for the operator to assess the status of the task and to select the appropriate branch. They also act as a memory aid to minimize biases and augment your working and perspective memory. Now, one common requirement for all checklists is they all require available, unambiguous, and precise data. A checklist and not overcome the lack of appropriate data at the right time, and, the right data at the right time, a checklist just doesn’t work without that.

So looking at this flow chart, this is an example of a flow chart for checklist use, the first question to ask is are there meaningful, deterministic values, and if not, well maybe there are sub-tasks that you can create a checklist for. And if not, then you know, it’s okay to say a checklist isn’t the best approach. It isn’t a one-size-fits-all or something that’s going to solve all of your problems. It’s not the silver bullet. And then if there are meaningful deterministic values, then consider whether the data are available, unambiguous, and precise, and if so, then does sequence matter. If sequence doesn’t matter, then do the items need to be rated or ranked, and if so, create a criteria of merit list, else a laundry list approach is warranted. If sequence matters, then consider whether the sequence is linear, and if there’re binary options or just a singular linear list. If there are binary options, then you want to consider a flow chart. So understanding your task, and intent of going through this is just to say that it’s incredibly important that you understand the task and the data that’s available and needed before you start designing assessment.

So next slide. In 2008, Hales and colleagues conducted a systematic review of checklist use, and it was paper checklist that they were looking at. And they concluded that one problem with checklists is that they’re used inconsistently. And they identified this as a result of the lack of respective standardized methodology for the checklist design, development, and implementation. And in their report, they also lamented that there was a lack of controlled study to assess the effectiveness of checklists. So Hales study in 2008 was done before the widespread implementation of Electronic Health Records, or EHR adoption has dramatically increased since then. EHR allows implementation of electronic checklists. So imbedded in your work, it’s important to support the clinical workflow. And as we were thinking about this, we thought, well it’s possible that the impact of checklist has changed. And so because EHRs have the potential to increase consistent use and standard methodologies have been published since 2008, we wanted to reassess checklist use in health care. And so we conducted a systematic review of electronic checklist, implementation in health care with the objective of first, we wanted to better understand the types of electronic checklists. How and where they are being used, and second, to identify the successes and failures of integrating electronic checklist into health care flow and documentation. So next slide.

We conducted a systematic review in MEDLINE. We used the keywords “electronic” and “computerized” in conjunction with checklists. And we used both of these terms because our preliminary searches we found that in clinical research report, “electronic checklist” was used; we found 18 results, and only 5 for “computerized”, where, in the search for PsycINFO which includes aviation decision support reports, “computerized checklist” is used far more often; 925 results within “electronic checklist” with just 3 results. So we used both terms in search [inaudible 40:16] in MEDLINE. And I want to say at this point that I was very surprised that we did not find more results for our checklist in MEDLINE. I thought that, you know, we were going to have a problem with too many things to review, but if you look at the next slide, we only identified 23 slides with that search. And I had extended it to flowcharts, but as you know in health care, flowchart also turns up a lot of irrelevant things to checklist. So we looked at the 23 studies, and 8 of the studies had to be excluded unfortunately because they were not, didn’t meet with our criteria. One was a paper describing e-checklists for business efficiency at a call center. There was an opinion article that reported previous uses of checklists with no data, there was a paper in French and I don’t speak French, a paper that described the use of e-checklists to prepare research, and there were a couple of others that didn't have sufficient content to assess the electronic checklist use in health care. So we ended up with 15 studies being considered.

So after analyzing the papers, we found that the most popular design study was comparison between pre-implementation and post-implementation with 11 studies. Only 4 studies were experimental designed, and because of the central assumption that checklist use improves operator reliability, most of the reviewed studies focused on measuring clinician adherence after implementing an e-checklist. So as a result, 14 of the 15 reviewed studies focused on changes in human performance as measured by increased operator reliability. Only 3 studies examined the impact of checklist on patient outcomes. As most studies assess e-checklist based on increasing adherence to some formalized procedure using only adherence as the outcome measure, and unfortunately these studies provide no evidence that increasing adherence translates into direct or even indirect medical improvement. 7 of the studies mention patient safety as a motivator for the use of checklist, and 4 studies implemented checklist to improve documentation. So let’s go to the next, well, the numbers, if you’ll look at that, the numbers don’t all add up to 15, because some studies had multiple measures and motivation.

So if we look at the next slide, checklist types were often not specified, although the majority of the studies appear to use laundry lists; 9 of them. No study reported using the criteria of merit; e-checklist. 11 of the 15 [inaudible 43:28 to 43:33] studies found mixed benefit, and 1 study found no benefit. This study that found no benefit, and founded e-checklist used compared to face-to-face prompting. So in the other studies, the outcome measures were confounded by the study design in that e-checklists were also part of a automated treatment plan, they said 1 study included training, and another confounded with improved electron reminders other than e-checklist.

Next slide. So with 11 of them, well checklists in general have value as decision and memory aids, and the results of this review suggest that this is also true of e-checklist. The large majority of the studies measured success as adherence to following the checklist. 2 studies also measured positive changes in clinical outcomes, but when the use of checklists promote procedures based on clinical best practice, which have been shown to impact patient outcomes, it seems to be assumed that the checklist is beneficial. And while this may be true, an evaluation of checklist, you should also consider providing evidence for the association between increased adherence and improved clinical outcomes. It may also be true that increased use of checklist in the health care context may contribute to checklist fatigue. Checklist fatigue is, ‘I have too many checklists and I may start mindlessly going through them.’ The number of reduced studies that we examined and considered the long-term impact of e-checklist, but it’s not clear what the impact of additional checklists on checklist adherence would be, and none of the studies mentioned or even considered the issue of checklist fatigue. You know, checklist fatigue, going mindlessly through the checklist without careful consideration of the patient and the context, you know, those march with system long cognitive [unintelligible 45:57] rather than the intended increased cognitive control of System 2.

So the implementation of e-checklist may benefit from a sociotechnical perspective. None of the studies reported an in-depth investigation of the fit between sociotechnical, between social and technical systems. One study did report resistance to using a checklist based on access and familiarity with computer systems, but for most studies, the use of checklist was compelled by the study design. Only two studies considered the voluntary use of the checklist. So in general, the literature reviewed does support the view that integrating the e-checklist into the existing workflow is of critical importance for successful adoption. The gap between checklist design and checklist use requires clear guidelines on how to translate the results of a study. Sociotechnical analysis into recommendations to increase the likelihood of teacher successful implementation. However, our review suggests that despite attempt to offer guidelines for checklist creation and use the researchers seem to rely on their intuition to integrate the checklist use into clinical practice. They didn’t tend to incorporate previously published guidelines for checklist use into their study design.

So the next slide, you know, one of our intents was to update the 2008 study by Hales and colleagues, but unfortunately we share the conclusion that there is a lack of using effective standardized methodology for checklist design, development, and implementation. And we also lament the lack of controlled studies to assess the effectiveness of checklist, even though we found that paper checklist/electronic checklist both offer potential for improving health care. So the question is, is the problem that controlled studies of effective checklist aren’t being done, or are they just not being reported? And as researchers in the audience, you know, I challenge you to think about what would create a controlled study. What would a controlled study mean and how instead of those questions in your implementations of checklists.

So our review suggests several other questions for consideration, you know, including the sociotechnical question of the conditions required for successful design. What is the cost of using checklist, and how can checklist be implemented so that adherence is insured, but performance on the checklist task and other tasks aren’t degraded, and how can checklists be optimized to mindfully guide the users through the task? And, with that, there is a link to the paper, and I believe all of the papers in the supplement are available with free access until September 27th of this year. So I’d like to open it up to questions.

Molly: Wonderful. Well, thank you so much to all three of you for your contributions. We do have time for questions now. For our attendees, if you joined us after the top of the hour, I just want to let you know how to submit your question. Just go ahead and go to the control panel on the right-hand side of your page, click the arrow next to the word questions down towards the bottom. That will expand the dialogue box, and you can then submit your question or comment there.

And the first question we have: I’m having a hard time seeing how dual processes line up with these studies. Is it possible to be more specific about how and when these processes fit into the design of the study or the implementation of it?

Dr. Charlene Weir: I will take a stab at that. This is Charlene. They line up in a couple of different ways, but one of them is to demonstrate that for successful implementation, the overarching goal is to take something that is automatic and then move it to a more deliberative concentrated attention absorbing event, and then move it back to automaticity. That’s the whole point of the implementation process. So sometimes people implement, make mistakes with implementation because they don’t notice the degree to which something is automatic already imbedded. That’s what they mean by workflow. It’s one thing to say workflow, but when you say workflow, you mean that the communication process, the information exchanged, where people go from point A to point B, the environmental cues that are controlling that behavior elicit automatic behavior. It’s very much like driving. There’s always some kind of attention put on it, but there are many times when we’ve ended up on our driveway on the way to the grocery store because we say things can run without much attention control. So when you start implementation, you have to pay attention to what’s automatic and what’s not. And then you have to decide how to change people’s behavior and change takes a lot of cognitive resources. If it takes a lot of cognitive resources like we were talking about an EHR change, then there has to be substantial effort on building skills, because they have to re-learn the skills, the linkage between their behavior and environmental cues, and they only, it takes like 20, 30 repetitions to build associative levels, associative links at the level that you could say we could become automatic again. So paying quite attention to that, the skill, it’s not just one thing to know what to do, it’s you have to do it so often that it’s automatic. So if you think if the change is substantial, it takes a lot of cognitive effort, even if it’s easy in a way. You know, for example, if you have to change, if nurses have to start doing a pneumo vax assessments and there’s some, it takes a while for them to do the assessment, do it automatically, understand the way it varies overtime, and then be able to implement that without much cognitive load. So any change at all will take a lot of load, and so attention to that means assessing what the demand is. So for my study, the self-efficacy is a rating of estimates of behavior skillsets. So if something’s complex then you should aim to raise self-efficacy to high levels, and then by the time you can do that, then you have successful, it goes back to being easy to do in other words; you don’t pay much attention to them. And then the checklist, it’s clear that implementing checklist means that you have to pay careful attention to where the cognitive load will be, and it’s always going to take a little because you have to pay attention to it, but if you can make it seamless with workflow. In other words, if something’s going to beep at you if you don’t follow the path, it’s better than having to follow the path. So you have to think carefully about the complexities of cognitive load; what’s automatic, what’s not. And then where are you going to have to actually support System 1. If something’s very complex, if it takes a lot of thinking and you need what-if scenarios and simulations, then you’re not going to go to automaticity. You’re going to support, clinical decision support, by giving clinicians lots of evidence, lots of tools, lots of information so that they can explore their world sufficiently in order to take advantage of their System 2 brain, which is pretty good at thinking. But when you do that then, now you have to make sure that there’s no other interruptions, there’s no other conflicts with their effort. So basically, the rule set is support automated behavior as much as possible through environmental cues, give enough time for change processes to go into learning so they become more automatic, and if something’s very complex, give human beings enough information to actually make decisions without interruptions.

Dr. Heidi Kramer: I think the key to checklist is to have them serve as reminders to the information not to miss so that the operator, the clinician, can be able to use their mental faculties for the best use, which is actually comprehensively understanding the information and making decision, and being able to attend to the current context, the current patient. So it is a matter of switching appropriately between System 1 and System 2.

Molly: Thank you both for those replies. We actually have a question, pardon me, from your colleague Dr. Samore.

Go ahead.

Dr. Matthew Samore: Okay, thank you Molly. So following-up on the last question, so Heidi and Charlene, can you comment on the use of checklists on a temporary basis to support the conversion to automaticity, you know, to ingrain habits, and then to avoid checklist fatigue, potentially withdrawing the checklist, you know, from the workflow. Did you encounter studies that used that approach? And I guess maybe a sub-question is to Heidi, it seems to me that maybe some cases of implementation of checklist might have been labeled or described as implementation of algorithms, electronic algorithms, and I wondered if you considered a search on those terms?

Dr. Heidi Kramer: To answer your last question first, we did not consider searching on algorithms. That’s such a good point. Where were you two years ago? And the other, the use of a checklist on a short-term basis, I think that really calls out the need to understand the task. Is it something, is it a training issue that, you know, of course the environmental cues could be better used than some sort of external, and if you can use, you know, cues in the environment that can reduce the use for checklist, then I think that’s, you know, certainly a good idea. But all checklists aren’t created equal, and you do need to understand the task. But that’s a great question.

Dr. Charlene Weir: There’s a educational theory by Miramar. They talk about dividing up education into two parts. One of them is the comprehensive and the other one is the, sort of, the manual repetition, you know, skill level. And that kind of division is kind of frequent in the educational world. But things that you have to repeat, have to learn by, you know, your body has to learn it, you have to learn it automatically, you just have to repeat it over and over and over again. So you’re right. You could use a checklist automatically, but if the environment changes in any way, there’s probably going to be a slight decay overtime.

Molly: Thank you both for those replies. We are at the top of the hour, but we still have several pending questions, so I just want to ask our presenters are you able to stay on so we can capture these in the recording?

[unknown speaker]: Yes.

Molly: Okay, excellent. If any of our attendees do need to log-off, when you exit the session, please wait just a second while the feedback survey populates on your screen, and take just a moment to fill out those few questions. We do look closely at your responses, and it helps us to improve individual presentations, as well as the program as a whole. So thank you, and we’ll get right into the next question: Were clinical reminders included as quote checklists? Why or why not?

Dr. Charlene Weir: That’s you.

Dr. Heidi Kramer: That’s me. We did not, in our lit review search, we did not look at clinical reminders from any other aspect. On a general philosophy is the clinical reminders may, I’m not sure what the context would be for those clinical reminders.

Dr. Charlene Weir: Well, there might be some clinical reminders that sequence you though a set of behaviors, you know, but like you say, it all depends on the task.

Molly: Thank you. We do have a couple people. One person wrote in and they wanted to say, a great presentation. I’ve attached a link with a lecture relevant to today’s presentation called Clinical Decision Support: The Last Year in Literature, so if anybody is interested in that report, feel free to write into me, I’m sorry, that paper, and I would be happy to send you that link. Moreover, MIT cognitive scientists report that in complete checklists result in adults in an aviation class are vulnerable to unlisted sources of air, and then she lists the link to it. As you said, this suggests System 1 is being used for checklist completion. The VA will need to protect against this error.

Dr. Heidi Kramer: You know, in the checklist manifesto, he has a statement in there of instead of, let’s see, I think instead of redo, it’s, and I’m probably misquoting, but do concern. So I think if you change your method of using a checkbook from, oh, I’m going to read this, and then I’m going to do it, to one of acting, and then confirming that you have the right feedback, it switches the thought process to a way that it is more mindful and could reduce. So I think it matters how you implement the checklist and how you train people to use the checklist. The checklist is just there to remind you to think and to do an action, and then if you confirm instead of just okay I did that, I did that, I did that, or when you’re actually saying, well I will do that.

Molly: Thank you. Have you studied the time required to implement checklist in a real world clinical environment like O.R., and the benefit gained in patient safety adherence?

Dr. Charlene Weir: I like that, but I haven’t done it, but I think someone should, and I think they should make it a very carefully controlled study. And they should have appropriate outcome measures. And I’d love to read that paper.

Molly: Thank you. How have checklists been linked to improving patient outcomes via improved patient satisfaction? In short, how are such studies going to be linked to improving patient satisfaction overall?

Dr. Charlene Weir: That’s a really good question. I think that having patient, measuring patient outcome, measuring patient satisfaction and checking the correlation on that would be an excellent outcome measure for a checklist, but I did not look at this, we did not do that.

Molly: Thank you. That is our final pending question from the audience, but I would like to give each of you a moment to make any concluding comments you’d like. Dr. Samore, we’ll just go ahead and start with you if you’re still on the call. Anything you’d like to wrap-up with?

Dr. Matthew Samore: No, I just really appreciate the audience staying with us, and I thought that the presentations that Heidi and Charlene gave were fantastic.

Molly: Excellent. Thank you, and we’ll just go in order of speakers. Dr. Weir, do you have anything you’d like to wrap-up with.

Dr. Charlene Weir: That was a good compliment. I just feel like it’s worth considering a dual process framework, and integrated into the current implementation frameworks that people are using because I think it enriches and makes a more useful tool, and explains some of the variation in outcomes on implementation studies.

Molly: Thank you.

Dr. Heidi Kramer: Thank you. I appreciate the opportunity [inaudible 1:03:19] It was very interesting, and I think it really highlights the need for not assuming outcomes, or actually [inaudible 1:03:29] creating or going after the studies that can prove correlations and measure outcome directly so that we can implement the best methodology.

Dr. Charlene Weir: Yeah, go after mechanism.

[1:03:51 unintelligible] on the call.

Molly: Excellent. Well, I want to thank the three of you for coming on and lending your expertise to the field, and just so your audience members know, we actually were dealing with a power outage and no internet connection for the presenters today, so they did an amazing job working off hard copies of their slides, so I want to thank them for taking this session in stride and doing such a wonderful job. And I, of course, want to thank our attendees for joining us. I’m going to close out this session in just a moment, and a feedback survey will populate on your screen. Please take a moment to fill out those two questions. We do look at your responses closely. So thank you once again everyone.

Dr. Heidi Kramer: Thank you Moll, you’re so great.

Molly:Yeah. I just want to also plug next week’s session. It’ll be the third part in this miniseries, and it will be taking place on the 30th at noon, Eastern. You should have received that email announcement today, so please be sure to register for the third part in this 3-part series. So thank you Charlene, Heidi, and Matt, and of course Gayle Reiber for helping organize this all. Have a great rest of the day, everyone.

[ END OF AUDIO ]