Avoiding Hypoglycemia
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PRESENTER: Kulasa can come on up and she can take it from here. You have your thing and there's slides. OK. Thanks.

KRISTEN KULASA: All right. Thank you. So moving on to hypoglycemia and how we can try to prevent it from occurring. So here's our outline.

Iatrogenic hypoglycemia is a big problem. It's the most common cause of inpatient complications. It affects about 1.9 million stays annually, costing $4.2 billion per year, and it's responsible for about a third of hospital acquired conditions. 50% to 60% of these ADEs are preventable, and 57% are from hypoglycemic agents. With more than 10% of those on a hypoglycemic agent suffering at least one hypoglycemic ADE.

So how can we possibly prevent this from happening and how can we recognize people at risk for hypoglycemia? So there's a lot of different risk factors. Some we can do something about and some we can't. So the inherent ones that we can't adjust are your low BMI, advanced malignancy, age, liver, kidney, or heart failure. But we can be attuned to that and recognize those risk factors in our patient and maybe be more conservative.

Iatrogenic risk factors-- anybody on insulin or oral agents, there is always some risk, even with appropriate use. But that risk is magnified with inappropriate use or failure to react or anticipate those preventable problems. Overly aggressive targets or inappropriate prescribing, those are big risk factors. And then hypoglycemic events of those less than 70, about 50% are preventable, and those less than 40, 50% to 80% are preventable. But improved glycemic control and reduced hypoglycemia is absolutely possible.

So here's one study looking at an institution and what their causes of hypoglycemia were. Number one cause, being 40% of their cases, was reduction in enteral intake and that mismatch of the medication and the nutrition. They also found that there was poor hypoglycemia management and follow up. So less than 50% of patients had documented euglycemia within two hours of their event. Was this because they weren't treated appropriately or just because it wasn't documented? We don't know.

Average time to documented resolution was four hours and three minutes. And remember with hypoglycemia we're talking brain cells here. So you might have treated it, but we need to prevent it, because not all hypoglycemia is treated with one round of treatment. And the median time was 2 hours and 25 minutes. So this is all also important data to be following. That we want to try to prevent any case we can from occurring, but when they do occur, we need to make sure we are promptly treating them and saving brain cells.

So here's another study. This was done by Dr. Maynard at our institution and published back in 2008. They took 130 ward inpatients who were monitored for glucose, 65 consecutive cases with iatrogenic hypoglycemic day. They matched one to one with controls who weren't hypoglycemic. And they examined risk factors for hypoglycemia.

So you can see very similar to the other nutritional interruption and discordance was our top cause. Also, those with a prior hypoglycemic day. Hypoglycemia begets hypoglycemia. Of basal bolus errors-- that creeping basal violating the 50/50 rule was a big problem. And our management was also extremely poor. We didn't follow our own protocol, there was poor or absent documentation with prolonged time to resolution, and frequent failure to prevent the recurrent hypoglycemia.

So what are some of these other more common failures leading to hypoglycemia? So we've talked a lot about inappropriate prescribing and this failure to respond to an unexpected nutritional interruption. We talked about the poor coordination of nutrition delivery, monitoring, and insulin. And then failure to respond to a prior hypoglycemic event. That's the clinical inertia. We have to put it in the provider's face and say, this didn't work yesterday, what are the chances of it working today and have we done anything to try to prevent that?

So other failures include monitoring and measurement deficiencies, with only 41% of hospitals actually utilizing their glucose data to track glycemic control and hypoglycemia rates. You will never fix it if you don't even know it's a problem. So metrics are extremely important. Concurrent monitoring to manage your outliers and those at risk for glycemic excursions.

Storing and dispensing-- too many insulin concentrations lead to error. Keep it simple. Really, really try to minimize what's on your formulary. And then administering-- there's insulin pen errors. There's certainly vial errors. IV bolus and insulin infusions prepared outside of the pharmacy are very prone to error, having different concentrations. So again, we want everything down to the bare minimum. We need to be able to have those different complex insulin regimen.

So here's a study we published back in 2015. This was our experience over five years. So we were able to simultaneously reduce hypo and hyperglycemia in our institution. We were able to reduce our severe hypoglycemia by over 50%, hypoglycemia less than 70, by about 25%, while simultaneously also reducing hyperglycemia by almost 25%. And we did it the exact same way-- really trying to address these most common errors. Them being the prescribing, the dosing, the monitoring, and the coordination with nutrition, and then responding to the hypoglycemia.

So we just talked about this back in the order sense. This is the number one way to reduce both hyper and hypoglycemia is having those order sets, standardize everything, including your indication and holding parameters, and making sure all providers use them in a standardized way. That way pharmacy sees them in a standardized way and can help keep everybody on track in the validation process. And nurses can know what to expect when looking at these orders and recognizing if they're off protocol or not. So you have many different layers for safety checks.

So these are the best practices we talked about last talk, integrating into those orders sets. And then you want to have a series of linked protocols. So reinforce these protocols by multiple

methods and hardwire whatever possible. So we spent a lot of time in that first session on the sub Q insulin order sets. But once you finished that, there's all sorts of stuff still to be done. Your infusion protocol, that Therese talked about, perioperative management, standardization is key. That way everybody is on the same page and your glycemic control group of having all the people at the table when deciding what that standard should be-- that way everybody is on board and can adhere to it.

Hypoglycemia management, patient education, subQ insulin pumps we talked about. Just have a process in place. If you have resources, they're available at your hospital, and you choose to let patients stay on their insulin pumps, that is totally fine. There's a lot of institutions that do it. There are also plenty of institutions that don't have those resources and their standard is to take them off their pump and switch them to basal-bolus insulin. So it is very institution dependent, but you need to have a standardized process. Monitoring, coordination-- again, any transition you can think of-- and then provider education and competency. So there's always more to be done.

So here's a tool that we use when looking at our initial hypoglycemia rates. You don't have to look at all this. It's basically a tool that we did back in 2011. We went through three months of our non-critical care hypoglycemia and we looked at every single case and we categorized it to figure out what the cause is as our institution. We'd read all these papers, these are the top causes, but is that what's going on at our institution because the intervention that we're going to apply needs to be specific to our institution.

Here's another example of one proposed by the Federal Interagency Workgroup to prevent ADEs. Another example of we really need to categorize these hypoglycemic events-- the more real-time, the better. But even retrospectively, it's very helpful so that you can track your progress over time as you create interventions to adjust each of the top causes of hypoglycemia.

So here's our data back from 2011. And you can see the top causes, 42% of hypoglycemia at our institution, had everything to do with a mismatch of insulin and food, whether it be PO intake, tube feed, or a patient just going scheduled NPO. Those were our top causes of hypoglycemia. So then we looked at each one of those processes and came up with solutions to help reduce that.

So here's the guidance that is buried into our order sets. Basal nutritional correction-- so the new orders are not required for a scheduled temporary NPO. So all our indication and holding parameters are built-in. So this was pretty standard. Basal insulin should still be administered even if the patient's NPO or has temporary interruption of nutrition. That was there back in 2011, that has not changed. What did change is we added some verbiage here in our nutritional insulin giving the nurse the ability to-- I should say, hold or delay up to 30 minutes past first bite of food and to give them the ability to adjust per PO intake.

So before 2011, it was either give or not give. So this is actually the current verbiage. I think back in 2011, instead of this carbs, it just did less than 50%, 50%, or greater than 50% of the tray. It wasn't perfect, but it was a step in the right direction and it really, really, really helped to reduce our hypoglycemia, because it made the nurses pay attention to hey, there's a connection here between this whopping dose of Humalog I'm about to give and this tray I'm giving it with.

Just this year, we have further modified it to include carb counting. And we don't even do bicarb, we just do the less than 2, 2, or greater than 2 carbs. Which is equivalent-- because all our trays come with four carbs, so it's equivalent to less than 50%, 50%, greater than 50% of the cards on the tray. Because we were seeing with room service in particular, a lot of patients are ordering no carbs on their tray. Therefore, from the beginning, I don't care if they eat half the tray or all the tray, they're never going to warrant any nutritional insulin.

So here is our algorithm that we developed for nutrition on hold unexpectedly. So this is the patient who's pulling their KO feed, going down to CT scan or to the OR. This side has to do with IV insulin, this side has to do with subQ insulin. And the concept is the same. On this side, you either have to turn the insulin down or replace the dextrose source. And on this side, you can't turn the insulin down because it's subQ, so you have to, at a minimum, increase frequency of your monitoring. And if you are finding you're trending down towards 100, you replace the dextrose source. And both of them we run D10 at previous tube feed rate.

So here's our best practice alert in Epic, that Therese mentioned before, that appears when zero is charted for the tube feed rate and the patient is on insulin. It's got a link to that algorithm guidance of what to do about it, but it's definitely not a perfect solution, because of the delay in charting. And a lot of times, they don't chart if they're turning it off just to bathe the patient, or because of a high residual, or something they're not charting that. And on the floor is when they're just charting Q shift, it's usually too little too late. It works the best in the ICU when they're typically charting every hour.

Here's our pink sign that we came up with. This is a bright pink laminated form that hangs on the IV pole with a bright pink sticker that goes on the tube feed pump right next to the button where they go to adjust it or turn it off, as a visual reminder hey, this patient is on insulin, something has to be done if you're messing with this. This is what it looks like. This is the front and then on the back it has this algorithm. So the nurse has it right there. They don't have to go find it in the binder at the nursing station. They don't have to go through Epic to try to locate the algorithm.

Therese mention this too-- our nurse driven hypoglycemia protocol. They don't need to wait for orders. This is perfectly in scope of practice. You have it laid out here of what to do when hypoglycemia occurs. Time is brain cells, we'd like to keep them. So here is our hypoglycemia protocol. Very similar to the previous one at Therese's hospital. But we have this extra step too of assessment. Once you've treated the hypoglycemia, I want you to think about it in real-time of why that event occurred. Did it occur because the patient just vomited up their lunch? Did it occur because our tube feed was interrupted? Did it occur for no reason whatsoever and maybe I need to contact the doctor for a dose adjustment?

And then in our hypoglycemia documentation right here, it matches-- it has the protocol built-in. So that as they're going through their documentation, it's asking the possible contributing factors and it's got their differential right here to choose from. So again, trying to get them to think of what happened. Because when I go look at this the next day or the next month when I'm doing a retrospective review, it's really hard-- I'm not there at the bedside to know if the patient ate or not, especially because documentation is less than ideal. So it's hard. So in addition to the

ordering, you've also got the relationship of your insulin monitoring and tray, and you've got your failure to appropriately monitor for insulin effects and adjust accordingly.

So metrics-- recommendation from ASHP. Every hospital should prospectively monitor and measure rates of hypoglycemia and hyperglycemia, insulin use patterns-- are we using basal bolus correction? Are we only using basal correction? What are we doing at our hospital? And some sort of monitoring of your coordination between the insulin, the glucose, and the nutrition.

Are you monitoring that? Are you looking for that time gap? Is there any accountability for the process you have in place to make sure it's effective? Because again, just because you build it, they don't necessarily do it. And you have to continuously monitor that in case it needs to be adjusted over time. So real-time institution-wide glucose report should be provided to health care team members to ensure appropriate surveillance and management of patients with unexpected hypo and hyperglycemia.

So why is data so important? We just had a conversation before on how important data is to your quality improvement efforts. One, it tells you where you are. Assess your baseline-- how are you doing? It assures your team and medical staff protocols are safe and effective. Is my hypoglycemia getting worse because I implemented these order sets or is it getting better like I think it's supposed to? So you can track that progress over time and make sure you're headed in the right direction and you're achieving the results you think you were going to.

It helps you compare like units to each other, prioritize your efforts in the worlds of limited resources. We can't do everything at once, so where do we need to prioritize and where do we need to focus our efforts first. And then benchmark, compare performance to others. We'll go through some of the SHM benchmarking, but Meg showed how nicely you guys have benchmarking data within the Washington State Hospital Association. And then assess your trade-offs between glycemic control and hypoglycemia. Do you have amazing hypoglycemia rates, but out of this world hyperglycemia rates? Because that can be achieved by doing nothing.

[LAUGHTER]

Or are your hyperglycemia rates amazing, but you have extremely high risks of hypoglycemia? That it's a significant trade-off for patients.

So which Glucometrics do we look at, which unit of measure? So the unit of analysis is questioned, there is no standard metric. Individual reading is not as recommended as the patient day or patient stay metrics. There's no consensus. Society of Hospital Medicine offers a variety of measures and your HENs offer a variety of measures that are often standardized within themselves.

Hypoglycemia per the ADE is typically defined as less than 70, with severe less than 40, but most of the HENs are all using less than 50. So again, anything is better than nothing. And having that standardization and benchmarking is so important. Day weighted mean greater than 180. Percent patient-days with severe hypoglycemia and recurrent hypoglycemia is a big one. How many patients in our institution that have one event, then go on to have another? Because

that means we're not addressing the initial event and implementing or taking action to prevent that second and third and fourth.

So here's an example of the SHM glucometrics. It's very convenient. It has its limitations as everything, but it uses only point of care data. You take all your hospital point of care data, you dump it into their system, and you can slice and dice it any way in real-time that you want. So if you want to look at just your critical care data or your non-critical care data, you can do this. So we will utilize this. And just recently, I had to create a proposal to try to expand our glycemic control team-- we want to hire another nurse-- and so they were like, well, I'd like to see your data over the last three to five years. And I could go there, and I just pulled it in there, put my time-frames, I could graph it out, and it was super quick.

So the data is presented in table form and in graph form, so you can quickly look at it and present it in whatever way you need. And then, you have these benchmarking reports that come out about twice a year. So you can compare yourself. Now we're up to over 100 hospitals across the country that are utilizing it, so we have more people to be able to compare ourselves with. And we can compare like hospitals to like hospitals. So now, as part of the benchmarking, it'll highlight your column based on what kind of hospital-- size of hospital, academic, rule, non-teaching, teaching.

So as part of these reports, you get a hospital number that you only know yourself and it can highlight where you stand. So here's an example of non-critical care hypoglycemia less than 70, and you can see I'm not doing so bad. And then here's the best graph, where it weighs your hypo and hyperglycemia on one page. So this is the top quartile for both. You are an ex top performer in both hyper and hypoglycemia.

And what we talked about before is you want to know where you are, even if it's not perfect. Am I up here, where I have really high hyperglycemia rates, but really low hypo. This is the guy who might not be doing anything. Here's the guy who's pretty aggressive. Look at how low these hyperglycemia rates are, but way too high hypoglycemia rates. Or are you this guy? It's a big problem, because theirs is just not working. Start from scratch, reload.

And here's an example of those graphs I was talking about. So this is what we did for when I had to put it together. This is our five year hypoglycemia Less than 70 and then the less than 40. And then here's our trend of recurrent hypoglycemia, that's another metric. Is it bounces all over the place, but you can see the overall trend is down. That we are getting to that initial event and working on preventing subsequent events.

So in summary, these most common failures and strategies to address them. Inappropriate prescribing is done with the order sets. Your embedded clinical decision support and mandatory use whenever possible. Ongoing monitoring for inappropriate prescribing and just in time intervention. I didn't get to that part, but you can do active surveillance. Active surveillance is when you are in real-time monitoring for these outliers. So our team does that in our hospital where we use Epic.

And on a daily basis we can look-- I have reports for hyper and hypoglycemia. So my hypo tells me all patients that have had a blood sugar less than 80 in the last three days and we set our level at 80 because I want to find those that are 75 and getting towards hypoglycemia and send a Big Brother page out to the team saying, hey she's at 80, first thing in the morning, we can use a little less Lantus. Or hyperglycemia-- your patients on the hyperglycemia lists, we've got to do something. And it helps to reduce that clinical inertia.

And I can tell you active surveillance can be done regardless of the resources that you have at your hospital, but a lot of our set points might be adjusted based on how many patients are in your hospital, how many resources you have. Some people might have just one person that can look at it once a week and that maybe they'll be like, I just want all sugars less than 50, who are also on insulin, who also have whatever-- not on basal insulin. Or I want to look at sugars greater than 300 and A1C greater than 10, and no basal insulin. So you can really adjust for the number of patients you want to show up on any lists.

Failure to respond to unexpected nutritional Interruption. Be creative, whatever you can find that works in your hospital. Protocols and education, and education, and education, and education. Methods to reduce interruptions in tube feeding. Do whatever you can and let me know when you figure something out.

[LAUGHTER]

And poor coordination of nutrition delivery, monitoring, and insulin delivery have clear direction in your protocols and order sets. I teach all our residents about illegal insulin orders and our pharmacy not to validate illegal insulin orders. Every insulin order should include an indication and holding parameter. Regular education and competency training and then redesign the process as needed. We just switched a little over a year ago to room service at one hospital, and we had to redo everything there. We're supposed to be going to room service at our other hospital in the next six months. Again, that's got to be all redesigned and redone.

And then failure to respond to a prior hypoglycemic day. Make sure assessment is part of your protocol. Competency and case-based training-- put the providers in the situation. And all the providers-- you can do it for nurses, you can do it for ordering providers. Give them a bunch of scenarios and be like what are we going to do, what are we going to adjust? Let's make sure this is really happening. And then monitor your recurrent hypoglycemia rates to see how well you are doing at that assessment and modification step.

So some of our take-home points-- opportunities for prevention are often missed, especially if you're not checking your data and following it. Assess needs to change after a hypoglycemic event. Existence of a hypoglycemia protocol does not guarantee good management. Make sure you're monitoring and seeing if that's being done. That's one of the SHM metrics, by the way, is your time to resolution in your hypoglycemia management. It's nice.

Have a protocol for unexpected interruption in nutrition. Give some guidance. At a minimum, they should be checking more often. And then have some alternatives of what they can do. Carbohydrate intake insulin rate should be tethered and accounted for. Flow sheets can help you

pull together that required data and make trends more apparent. Again, reduce the clinical inertia, make it as easy as possible for the provider to do the right thing. And you can't improve what you don't measure. That's it. Thank you.

PRESENTER: Now might be a good time for questions. I know I have one, but I'll let you guys start. And we have Linda will come around with the microphone so that everyone can hear the question, and then I can share mine too. So, great.

AUDIENCE: How do you assess sticking with the protocol? How do you assess sticking with the protocol?

KRISTEN KULASA: For the hypoglycemia?

AUDIENCE: Yeah, whether the orders are per protocol or the orders are outside of the protocol.

KRISTEN KULASA: So a lot of that can be done within your EHR. They can create reports based on an order set of which orders are being utilized per to that order set versus not.

AUDIENCE: How much time does your facility spend gathering and assessing these metrics? The FTE or who does it?

KRISTEN KULASA: So we have a pretty robust system in place. Me-- I'm full time to inpatient glycemic control. I have another half-time endocrinologist. Now, she doesn't do a lot of the quality stuff, she does more of the day to day, because we're split in two locations that I can't physically get to both location. And then we have four nurse CDEs.

AUDIENCE: Two per hospital?

KRISTEN KULASA: Mm-hmm. That help do a lot of this. The majority of what they do is education for the patients and education for the providers.

AUDIENCE: How big is your institution?

KRISTEN KULASA: We have at one hospital it's about 450 beds and the other as of last month now has about 300-350.

PRESENTER: And I think, we were chatting over lunch, if there is-- obviously, there's limited resources everywhere, both large and small. And one thing that could maybe help spur resources getting given to you would be providing those telling patient cases while you're requesting a resource. They had some good examples-- I'm sure each of your hospitals have those examples that are incredibly frightening that can-- whether it means you have to do a couple of root causes or things like that to help prompt the allowance of some resources, even if they're just temporary, to do some data collection and to get some protocols in place. But that was a good question.

AUDIENCE: So our institution does not have a clinical presence for glycemic control team. It's just interested parties meeting on a regular basis. We don't have a frontline clinical presence. But

our pharmacist did-- we did a little pilot program where we did some surveillance. And I could get into the details of how we pulled that out of our EMR, but basically, active surveillance by our pharmacist and then them sending pages out to the team.

And that worked really well and it's just part of their high-risk med review. So it just became part of their standard work and it's a small group of providers. It's a little easier to train. A smaller pool of providers, but of all the interventions we've done-- and we've been at this work for about six years-- of all the interventions that we have made that was the single highest yield intervention-- was pharmacy surveillance.

PRESENTER: And then you text out to your providers?

AUDIENCE: Yeah, the pharmacist will text either text page, an SBAR, or drop a clinical note and just copy the provider on it.

KRISTEN KULASA: I know at UCSF they have a virtual glucose management system. Yeah, so it's very similar to the Big Brother pages that I send out. But he does Big Brother notes. And it becomes a culture-- everybody is like and I got to get the blood sugars under control because I don't want a Rushakoff note in my patient's chart.

AUDIENCE: I think the reason that surveillance works-- so I'm a hospitalist, I'm not an endocrinologist. I take care of patients who have 57 problems and diabetes is number 48 on the list of 57. And so even though I'm a big diabetic champion and I like playing with insulin doses, I miss it sometimes, so I like it when my pharmacist colleagues page me say, hey, BTW, you missed this one.

[LAUGHTER]

Which is really embarrassing, particularly if I'm with residents, because i got to get it right. So anyway, I think the reason surveillance works is because patients are often there with a life-altering hospital stay. Maybe they've had an MI, or they're going to lose a foot, or something like that. And it's just on this long list of problems and so having outside eyes to percolate that up to the surface and give you a concrete actionable recommendation is really, really helpful. And again, that was our single biggest impact intervention.

KRISTEN KULASA: Agree.

PRESENTER: Great question. Any more? I have a question. So you guys mentioned the Society of Hospital Medicine coming as mentors. Can you elaborate a little bit on that? I mean not too very long.

KRISTEN KULASA: Yeah, I know there's a variety of options with the Society of Hospital Medicine of things that you can get involved with. One, from the absolute free standpoint, there is a guide that is published on their website that is absolutely free. It's like 300 plus pages and it goes into details of practical ways to get a lot of this stuff done. So if you're working on a periop project and you want to go in there and be like, hey, I'm looking for periop, I don't need general

order sets, I don't need this and this. And you can go in there, there's a summary of the data, there's a summary of a lot of things that the hospitals do to address that and can give you a lot of different ideas.

Then I know in order to start uploading your data-- I don't know exactly how much it costs, but they're very much not-for-profit. It covers cost only. I want to say it's like 1,000 or 2,000 for two years. That gives you not only access to the implementation guide, but access to the glycemic control community. So it gives you-- on the online community, everybody posts their resources, there's a listserv, so you can be like hey, I want to do periop, what are you guys doing? Or how many of you guys have a glucose management team?

And then everybody responds and is like this is how we do it, this is how we get it covered, this is how we convinced our hospital. And you get those metrics. So access to all the metrics with somebody to guide you on how to do it which is very easy. And dumping all your point of care data on there and then slicing and dicing.

And then the next step is the mentored implementation, where you can get all that other stuff plus a mentor. I guess there's different levels. I don't know exactly all the details, but some are just an online mentor who does phone calls with you every so often, up to a mentor who will actually come out to your institution and help you out.

PRESENTER: I think something-- whether or not you do that, we hope that we can be a forum that you can bring questions. So the question on periop and the wide range of complexities that we can get into that, obviously we can't cover today while it's actually very, very content intensive. Bring that forward to me and also we try to-- if there's a question that I can't answer, we would like to bring it back out to other hospitals-- what are you doing? So I want you to feel comfortable in contacting me, contacting WSHA, contacting Linda-- she's our royal expert. And we're really trying to do our best to be able to meet your needs. So that's obviously a really great resource.

KRISTEN KULASA: Yeah, but you guys have something similar, too.

PRESENTER: Yeah, and we can have-- I can do a webcast monthly, if I get the interest, and people requesting certain things. We're happy to meet your needs. So just wanted to bring that forward, because there's all these different avenues that we could go down. I do know we have a roundtable schedule at the end, so it wouldn't be so bad to keep going. But any other questions, before we move on to our last major section? OK.