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2021 Lambrew Research Retreat; Harold Osher Award for Excellence in Clinical and Population Health

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Neonatal Hypoglycemia: A Comparison of Point of Care and Radiometer Glucose Tests

Maine Medical Center

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Conflicts of Interest

The authors of this study have no financial conflicts of interest to disclose.

Background: Neonatal Hypoglycemia

- Common problem
- Can be asymptomatic
- Can cause derangements in brain metabolism
- Ability to detect accurately is crucial
- Rapid, accurate identification is challenging

Risk Factors:

Infants born to insulin dependent diabetic mothers or mothers with gestational diabetes
Infants < 2.5 kg
Infants > 4 kg
LGA infants (>90% ile as plotted on Fenton curve)
SGA infants (< 10% ile as plotted on Fenton curve)
Gestational age < 37 weeks
Discordant twin (weight 10% below larger twin)
Newborns suspected of sepsis or born to mother suspected of having chorioamnionitis
Newborns exposed to any beta-blocker medications

(MMC protocol)

2018: Nova glucometer was the first glucometer to be FDA approved for use in ICUs, including NICUs

→ Maine Medical Center recently adopted the Nova meter

...but point of care (POC) glucose tests have not been well studied in newborns...

Our study:

We explored whether the Nova glucometer (POC test) provides comparable measurements to the ABL837 Radiometer whole blood gas analyzer (Radiometer Medical ApS, Copenhagen,DK) (ABL test).

Existing literature on NOVA in neonates:

Methods:

- Collected sample pairs
- Less than 10 minutes apart
- By heel stick
- 704 sample pairs
- September 2019 - March 2020
- Testing done only when clinically indicated (for symptoms or screening)
- 1st sample: POC glucose
- 2nd sample: ABL glucose

Analysis:

- Compared results between methods using Bland Altman plot
- Used ABL as the **gold standard**
- Calculated false positive rate (FPR) and false negative rate (FNR) for the POC test
- Chart review performed for all false negative POC values
- **Hypoglycemia is <50 mg/dL**

Table 1: Characteristics associated with the sample pairs

Variable	Measurement
N	704
Location	
Newborn nursery	309 (43.9)
NICU	395 (56.1)
Corrected gestational age at testing (weeks)	
<34	36.9 ± 2.6 67 (9.5)
34-36	239 (33.9)
≥37	398 (56.5)
Day of life	1.7 [1.3-2.5] (1-72.1)
≤1	6 (0.9)
1.1-2.0	445 (63.2)
2.1-3.0	130 (18.5)
3.1-4.0	44 (6.3)
4.1-5.0	12 (1.7)
>5.0	67 (9.5)

Figure 1: Bland-Altman plot, sample pairs collected 0-10 minutes apart

- Average difference between POC and ABL values: **-9.6 mg/dL**
- Wide limits of agreement (-27.4- +8.1 mg/dL)
- FNR: 3.2%
- FPR: 55%
- Using an offset factor of +9.6 mg/dL:
 - FNR: 36%
 - FPR: 18%

Table 2: Differences in test interpretation between ABL and POC for sample pairs collected 0-10 minutes aparta) Unadjusted data

ABL	POC			Total
	Low (0-50 mg/dl)	Normal (51-125 mg/dL)	High (>125 mg/dL)	
Low (0-50 mg/dl)	239	8	0	247
Normal (51-125 mg/dL)	247	205	0	452
High (>125 mg/dL)	0	2	3	5

b) POC data adjusted by +9.6 mg/dL

ABL	POC			Total
	Low (0-50 mg/dl)	Normal (51-125 mg/dL)	High (>125 mg/dL)	
Low (0-50 mg/dl)	159	88	0	247
Normal (51-125 mg/dL)	83	369	0	452
High (>125 mg/dL)	0	0	5	5

Conclusions:

- POC and ABL glucose tests are **NOT** equivalent
- High FPR → unnecessary interventions
- FNR of 3% → risk missing true hypoglycemia
- Offset factor makes things worse
- **These findings have implications for the choice of glucose testing method in neonates**

Changes in workflow:

- Using ABL test for all screenings in newborn nursery and L&D
- Increased use of ABL test in NICU
- Ongoing work to increase workflow efficiency

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Background

- The opioid epidemic has hit particularly hard in rural states where resources for substance use disorder (SUD) treatment options are particularly scarce.¹⁻⁴
- During the COVID-19 pandemic, social distancing policies required healthcare providers to turn to telemedicine platforms for the majority of their patient encounters.⁵
- Telemedicine, or the delivery of remote clinical services using phone or video, has been proposed as one possible solution to existing barriers to care access in SUD.
- Preliminary studies have demonstrated promising outcomes for various computer delivered therapy models for individuals with alcohol or opioid use disorder.⁶⁻⁸ However, much remains to be understood about the feasibility and efficacy of telemedicine in this particularly vulnerable population.

Methods

- We interviewed a sample of people who inject drugs (PWID), community partners (CP), and providers (Pr) who live in and/or provide services in Maine.
- Thirty-six interviews were conducted between April 1, 2020 and February 28, 2021.
- Line by line coding was performed using MaxQDA by RB, MK, and HL using inductive and deductive coding and applying the constant comparative method to analyze codes.

Discussion

- Substance use disorder treatment should not follow a “one-size-fits-all” model.
- Telemedicine offers a convenient alternative that may be useful under certain circumstances and may alleviate some of the existing barriers to care access.
- Some participants expressed concerns regarding making adequate connections over a virtual platform, while others felt well-supported during telemedicine visits.
- While telemedicine has the potential to reduce barriers to care for many, it is important to recognize its capacity to exaggerate disparities amongst more marginalized populations. Accommodating these difference will be critical in more widespread implementation of telemedicine practices.

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Results

Theme	Quote
Care Accessibility	
Improved	
Reduced Burden of Visit Frequency	"One thing they did amazing, is they let a lot of people get take homes. So we weren't coming into the doctor's office every week, twice a week, which was amazing." (PWID02)
Elimination of Transportation Barrier	"If [telemedicine] could be a nice step to helping merge Suboxone treatment into people's lives, so as to not sort of put their normal functioning at risk...we could take out several of those steps, which would let people get jobs and pursue housing and other things that they're working on." (Pr4)
Treatment entryway	"I think in some ways even people in the more rural areas who maybe...a drive would have been too far and just kind of prohibitive." (CP03)
Restricted	
Difficulty with Care Coordination	"...that [telemedicine] is going to work better than if a person has phone calls with three different people who are in three different places. I think that there was a fracturing of care as a consequence of moving to more remote models of care." (CP08)
Difficulty reaching certain populations	"... a lot of different services have become almost inaccessible right now if you don't have a cellphone." (CP 05)
	"It's not that she [a homeless PWID] doesn't understand the rules or isn't trying to follow the rules, it's that it's hard for her to find a private place with secure internet access." (Pr 6)
Patient Experience	
Improved	
Decreased Shame	"... but it's a lot easier not to see somebody and tell them how crappy you're doing, look them in the eyes. And it's a lot less shameful, I guess." (PWID 08)
Comfort of Home Environment	"... A lot of my women don't like the sort of scene before and after meetings. If they feel like it's almost like they're getting asked out and stuff like that. And they've said they liked the privacy of their own home and not having that sort of social interaction." (Pr5)
Worsened	
Decreased Structure	"So there's all the virtual NA meetings you could ever ask for, but it's really easy to not engage if you're slugging or just trying it out and then you relapse, whatever. It's really not set up right now for people to kind of thrive in a recovery setting just because there isn't anything that people can kind of show up, and be accountable, and all that stuff that we know is sometimes important." (CP04)
Decreased Peer Support	"Part of what life is like for people in early recovery, it was certainly my experience, was you're crawling out of your skin, but every night you get off and go to a meeting and there's other people there. And even if you sit there uncomfortably on your folding chair during the meeting, you smoke cigarettes before and after and you're part of a community and you don't feel totally alone and you're exposed to positive message." (CP 07)
Decreased Human Connection	"... and so I think not having that face-to-face, to me has meant a lack of consistency and a lack of physical presence to build that baseline trust with each other, which then causes a lot of gaps in the services that people need." (CP 06)
Decreased Privacy	"Over telemedicine, we see people lighting up cigarettes, taking off their shirt, walking around outside with the camera moving around, having kids or loved ones screaming in the background, so just the sort of stuff that can be unprofessional or poor etiquette for the other patients who are in the room." (Pr5)
	"I have a lot of women that suffer with domestic violence as well, and so like sometimes you could actually hear like the guy in the background." (Pr5)
Provider Experience	
Improved	
Better Understand Social Context	"... I got to see patients in their home environment, which was very educational for me. I got a better sense of their environment. I got a better sense of how the things were in their home, whether they had small things like their pets, how the house looked, whether they have privacy." (Pr0)
Personal Convenience	"... part of the problem for me is my job is driving to all these different clinics, interspersed with lots of meetings and things. And I spend a lot of my time driving around and running from place to place. And it's been really quite lovely to just get up in the morning and sit in one place and be able to do my whole job." (Pr3)
Worsened	
Telemedicine Fatigue	"Zoom fatigue" comes from being in too many Zoom meetings and having to really focus so much on so many people's faces at the same time. I am not able to have the same amount of meetings via Zoom that I would be able to have in person every day without feeling completely exhausted." (Pr2)
Missing Important Body Language and Physical Exam Signs	"... I mean, if somebody is really disheveled, you can tell on video, but there's more subtle signs that are hard to see." (Pr7)

Conclusion

- Telemedicine should be considered a viable alternative to in-person care when patients and providers agree it is appropriate.
- Telemedicine may offer an innovative solution to many of the barriers posed by more traditional 16 models particularly in rural areas.