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Diabetes Technology at Camp: A Rich Learning Environment☆,☆☆

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Over 20,000 children with type 1 diabetes (T1D) attend diabetes camps across the United States and Canada annually (Diabetes Education & Camping Association, 2018). Diabetes self-management technology is rapidly evolving so diabetes camps must adapt to these changes. Approximately 75% of children with T1D that attend camp use technologies such as insulin pumps, automated insulin delivery systems, continuous glucose monitoring systems (CGMs) and remote monitoring systems (American Diabetes Association [ADA], 2017). Without proper education and first-hand use, these devices can be intimidating and complicated for healthcare providers to utilize. Diabetes camp offers an intensive learning environment to allow healthcare providers the opportunity to observe and study these devices and, in turn, come to understand how technology aids T1D management (ADA, 2017).

Automated Insulin Delivery Systems

A common issue at diabetes camp is the determination of insulin dosing to prevent hypoglycemia in children who are more active at camp than at home. Automated insulin delivery systems, also called hybrid closed-loop systems, use CGM data and algorithms to automatically adjust insulin pump basal insulin delivery and can suspend insulin delivery if a low blood sugar is detected. These devices reduce nocturnal hypoglycemia (Phillip et al., 2013). At diabetes camp, healthcare providers work throughout the night to treat and prevent hypoglycemic events. Automated insulin delivery systems can reduce the burden of care and improve camper safety (Phillip et al., 2013). The usage of automated insulin delivery systems at camp results in tighter glucose control (Phillip et al., 2013) and improves glucose time in range in comparison to traditional insulin pumps (Ly et al., 2016). However, it has been found that it may take 2–3 days for some automated algorithms to adapt to the camp setting (Ly et al., 2016). It is, therefore, recommended to use a programmed temporary increased glucose target of 150 mg/dL, in order to prevent hypoglycemia, while the system adjusts to increased physical activity and a new environment.

One concern of utilizing automated insulin delivery systems at camp is the camper's capability to respond to device alarms. If alarms and prompts are ignored, the device may exit the automated insulin delivery program and return to a manual basal insulin delivery program. Additionally, the device may exit the automated delivery/suspend feature after administering the determined maximum basal for over 3 hours to correct hyperglycemia. It is suggested to adjust manual basal insulin rates to match the average total daily dose determined by the automated feature with a 10–20% reduction for hypoglycemia prevention at camp. Patient training for use of the automated insulin delivery system is intensive, but it has been found to benefit the camper and allow for improved glycemic control at camp. The healthcare providers making adjustments at camp should use these opportunities to educate students, staff members, and the campers on diabetes self-management technology.

Continuous Glucose Monitoring Systems

Continuous glucose monitoring is a method of tracking glucose levels every few minutes over 24 h. The system can generate data regarding the direction and rate of change in glucose levels. Continuous glucose monitors consist of the following components: a subcutaneously inserted sensor, a transmitter that is attached to the sensor and transmits data via Bluetooth, and a receiver (mobile device, compatible insulin pump or a device by the CGM manufacturer). Continuous glucose monitors measure the glucose in the interstitial fluid and an algorithm translates the value into blood glucose. As CGMs do not directly measure blood glucose, sensor values may differ from capillary blood glucose values. Some sensor readings may lag up to 15 min behind capillary blood glucose during times of significant glucose fluctuations. Alarms may be set to alert the wearer and mobile followers of rising and falling glucose, hypoglycemia, and hyperglycemia.

Devices such as CGMs simplify pattern management and help campers identify when to proactively seek treatment. Children with T1D enjoy using their CGMs while at camp but there is little evidence of glycemic improvement (Gupta et al., 2018). Although popular

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among the T1D diabetes community, diabetes camps have been slow to adopt the utilization of CGMs as older CGM models were not accurate enough for insulin dosing decisions. Newer CGMs are more accurate, straightforward in use, easier to insert, and are factory calibrated, instead of requiring finger stick calibrations. As technology has improved, the accuracy has improved allowing users to make treatment decisions based on CGM data. However, there is little research available on the use of the latest CGMs in the camp setting.

Freestyle Libre Flash Glucose Monitoring Systems (FGM) contain a sensor inserted under the skin and require the uses to wave a receiver over the sensor. One difference in this type of continuous glucose monitor is that it will not alarm or alert the user if a blood sugar is running low or high. Currently, FGMs are not approved for patients under the age of 18 in the United States, but some children use the devices off-label. Additionally, the current models in the United States are not accurate enough for treatment decisions, and they do not have sharing capabilities.

Camp healthcare providers find FGMs extremely easy to use with few failed sensor issues (Hansen et al., 2018). Campers also report high satisfaction with using these devices at camp. The most common issue reported with these devices in the camp setting is lack of adhesive and reinforcement resulting in the device falling off prematurely (Hansen et al., 2018; Piona et al., 2018). Although Libre Flash devices have not been found to improve glycemic control at camp (Piona et al., 2018), they do provide information that can be used to understand campers' glucose patterns. Healthcare providers can use these graphs to understand pattern management in T1D.

Remote Monitoring

Receivers using cellular data allow for remote data monitoring via apps and websites. Parents may monitor their child's glucose data remotely and healthcare providers can view data in between appointments. For parents of T1D children, leaving their child at camp is often anxiety-provoking, especially when losing the ability to view the child's glucose trends in real time. Parents who can continue to monitor their child's glucose data remotely have improved moods and quality of life in comparison to those who lost access while their child is at camp (Losiouk et al., 2018).

Some camps have used remote monitoring as a tool for healthcare providers. In a camp that had healthcare providers remotely monitor campers, 100% of nocturnal hypoglycemic alarms were attended to, as opposed to 54% of CGMs alarms that were not connected with remote monitoring (DeSalvo et al., 2014). Diabetes camp healthcare centers that are set up with these resources allow for CGM data downloads which can provide critical information for healthcare personnel to make insulin dose adjustments. These data downloads also offer real-time information on glucose fluctuations and insight into the daily nuances of diabetes management. Although monitoring can ease the responsibilities of healthcare providers and improve safety overnight for campers, using this technology has barriers to consider. It is often difficult to set up Wi-Fi in remote and rural areas and it can be unrealistic in some camp settings. An additional concern to note, as CGMs are moving towards mobile receiving devices, is that many camps still feel apprehensive about allowing cell phones and CGMs due to liability concerns for lost or damaged devices.

Learning Experience

Diabetes camps provide hands-on training for nursing students, experienced nurses and other healthcare providers to become comfortable with new technologies. Diabetes camps immerse staff in the real world experience of living with and managing T1D. Senior nursing students who attended diabetes camp for clinical hours had significant improvements in knowledge related to HbA1c and insulin action times which are two key concepts of T1D management (Vogt, Chavez, & Schaffner, 2011). Nursing students report also learning other concepts related to T1D management such as carbohydrate counting, insulin to carbohydrate ratios, insulin administration, insulin pump usage, and hypoglycemia and hyperglycemia treatment (Vogt et al., 2011).

In addition to hands-on learning and direct observation of technology, there are opportunities to learn from a diverse care team. Diabetes professionals that help run diabetes camps come from a variety of disciplines including nursing, pharmacy, medicine, psychology, dietetics and social work (Dean et al., 2014). Collaborative practice is common in diabetes management as two or more professions work together to provide quality patient care from different perspectives (Dean et al., 2014).

Conclusion

Diabetes technology is rapidly changing. These changes significantly impact the diabetes camp environment. Diabetes camps should accommodate and adjust to these technologies as they have self-management benefits in the unique camp setting. Utilization of new technology at camp provides healthcare providers of all levels a hands-on and interdisciplinary experience with T1D management.

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