

CONTINUOUS GLUCOSE MONITORING (CGM) ASSOCIATED WITH LESS DIABETES-SPECIFIC EMOTIONAL DISTRESS AND LOWER A1c AMONG ADOLESCENTS WITH TYPE 1 DIABETES

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Introduction

Continuous Glucose Monitor (CGM)

- CGM use is associated with lower A1c values in children but not teens when adjusting for sociodemographic factors (Wong et al., 2014)
 - Results demonstrate about a 0.27-0.30% decrease in A1c for frequent users and slightly smaller decrease for intermittent users (Rachmiel et al., 2015; Wong et al., 2014).
- Psychological variables such as diabetes-related worry and quality of life are not impacted by CGM use (DirecNet Study Group, 2006); however, studies examining associations are over ten years old.

Insulin Pumps

- Pump use in adolescents with type 1 diabetes has demonstrated lower A1c values even controlling for duration, adherence, and sociodemographic variables (Wong et al., 2015)
 - Pooled analysis of three large pediatric diabetes registries demonstrated about a 0.5% decrease in A1c with pump use (Sherr et al., 2016)
- Notably, no advantage of pump use over multiple daily injections has been clearly shown but switch from injections to pumps is associated with improvements in A1c, lower rates of DKA, and improved quality of life (Rankin et al., 2015)
- Family-perceived benefits of pump use include less injection-related distress, more flexibility with snacks and exercise, and more fine-tuned dosing control (Rankin et al., 2015; Forlenza et al., 2016)

Objectives

- To assess association between diabetes technology (CGM alone, Pump alone, Both [CGM+Pump], or No Technology) and diabetes-specific distress and A1c

Methods

- Data are from a study of the psychosocial impact of diabetes camps across the United States
- 854 adolescents and 1038 parents completed measures of diabetes-specific emotional distress. Parents reported on youth A1c.
- MEASURES
 - Problem Area in Diabetes (PAID-T and P-PAID-T) scales – self-report measures of diabetes-specific emotional distress.
 - Hemoglobin A1c – Parent-reported based on most recent clinic visit
- Demographic differences among technology use groups were compared using z-tests.
- ANOVA compared levels of technology use with distress and A1c. Cohen's *d* values with Hedges' correction provided effect sizes among groups.

Sample Characteristics

Adolescents were 14 ± 2 years, primarily Caucasian (90.8%) and female (56.7%). Most parents were mothers (89.4%), married or living with a partner (80.2%), and were highly educated [most participated in college (65.0%) or had a graduate degree (25.4%)]. Median family income was \$100,000. Mean A1c was 7.9 ± 1.6 . This value is slightly higher than ADA recommendation of 7.5 and lower than 9.0, the mean A1c of adolescents in the Type 1 Diabetes Exchange Registry.

Demographic Differences in Technology Use

19 (1.6%) adolescents used CGM only, 665 (54.6%) used pump only, 112 (9.2%) used both technologies, and 245 (20.1%) used no technology. Girls were more likely to use pumps alone (68.2%) than were boys (58.1%). Boys were more likely to choose no technology (27.6%) than were girls (20.4%). No other gender differences were noted in technology use.

Adolescents living with married/cohabitating parents, with more educated mothers, and with higher family incomes were more likely to use both pump and CGM together compared to those not using technology. Pump use alone was also more common in adolescents with higher family income than those not using technology.

In this sample, race and mean adolescent age were not significantly different among technology use groups.

Differences on Diabetes Distress and A1c

Older age was associated with higher adolescent distress ($r=0.08$, $p=0.01$) and higher A1c ($r=0.11$, $p=0.001$). Girls reported higher distress than boys. Having married/cohabitating parents was associated with lower mean parent distress and lower mean A1c than those living with single or divorced parents. Having married/cohabitating parents relative to divorced parents was associated with lower mean adolescent distress. Higher family income was associated with lower mean teen-reported and parent-reported distress as well as lower mean A1c. Minority youth did not report any difference in distress compared to Caucasian youth; however, parents of minority youth reported higher mean distress than parents of Caucasian youth. Minority youth had higher mean A1c than Caucasian youth. All reported comparisons above were statistically significant ($p<0.05$).

A1c values were significantly associated with both adolescent- and parent-reported distress ($r=0.24$, $p<0.001$ and $r=0.32$, $p<0.001$ respectively).

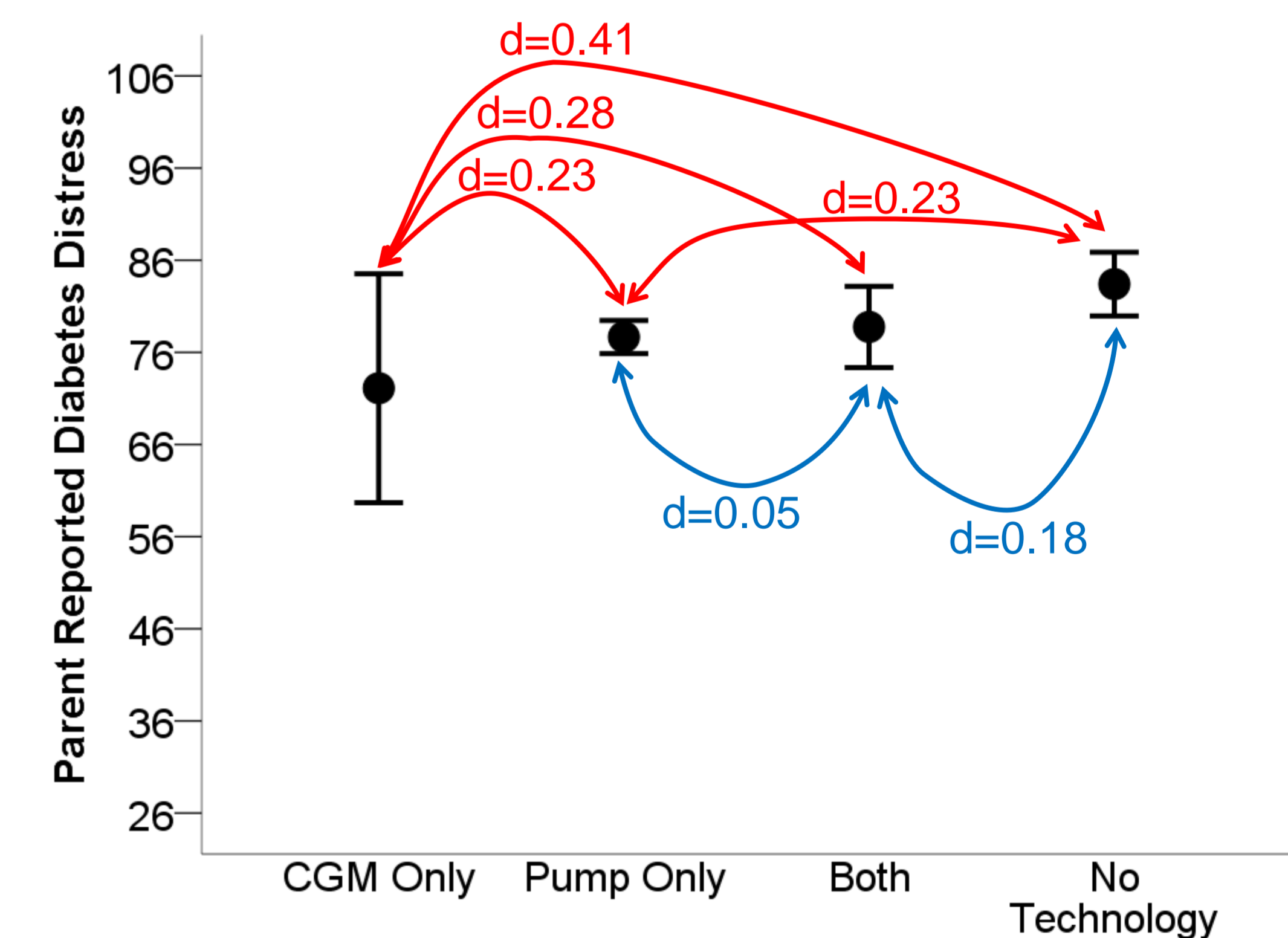
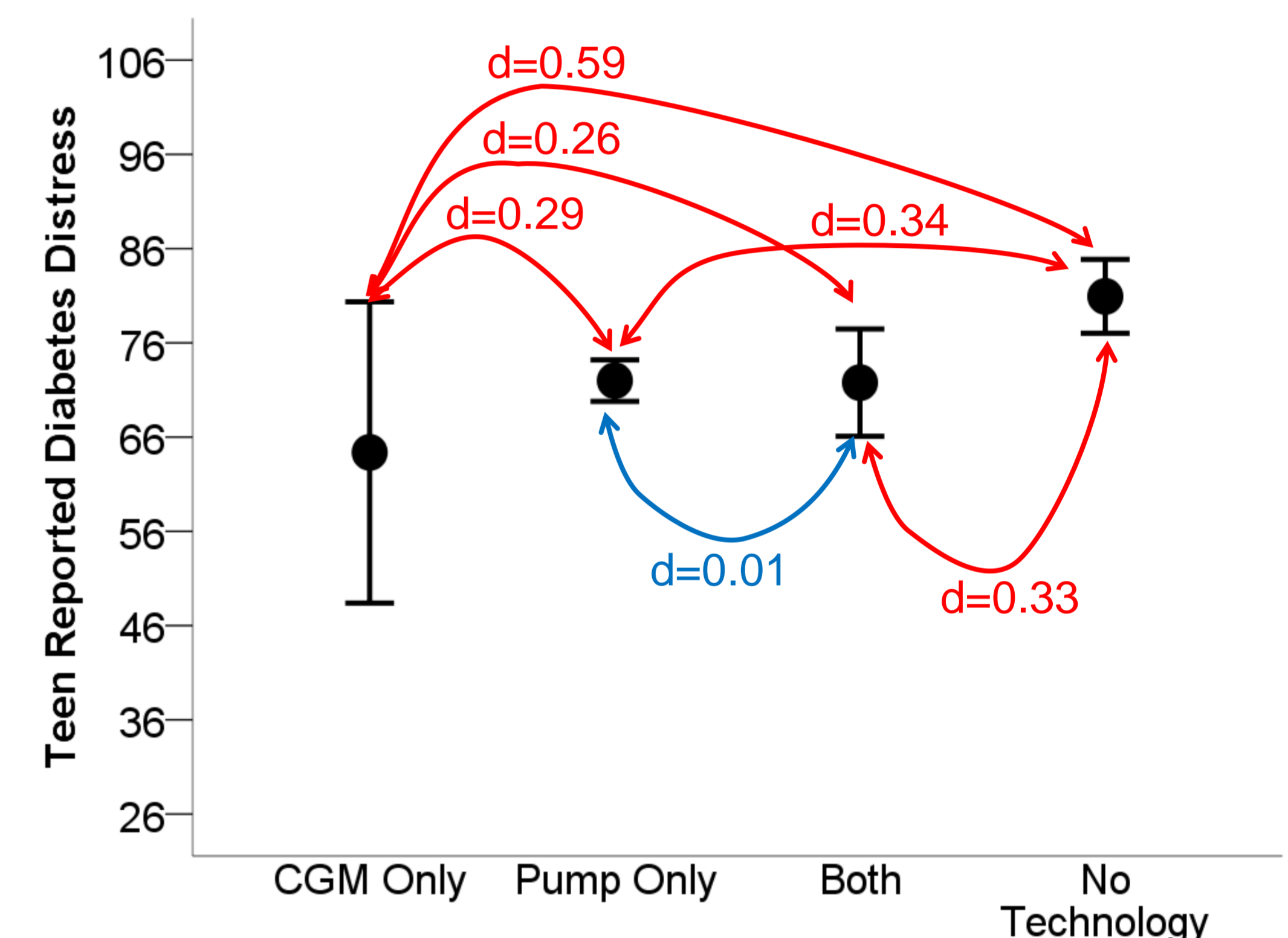
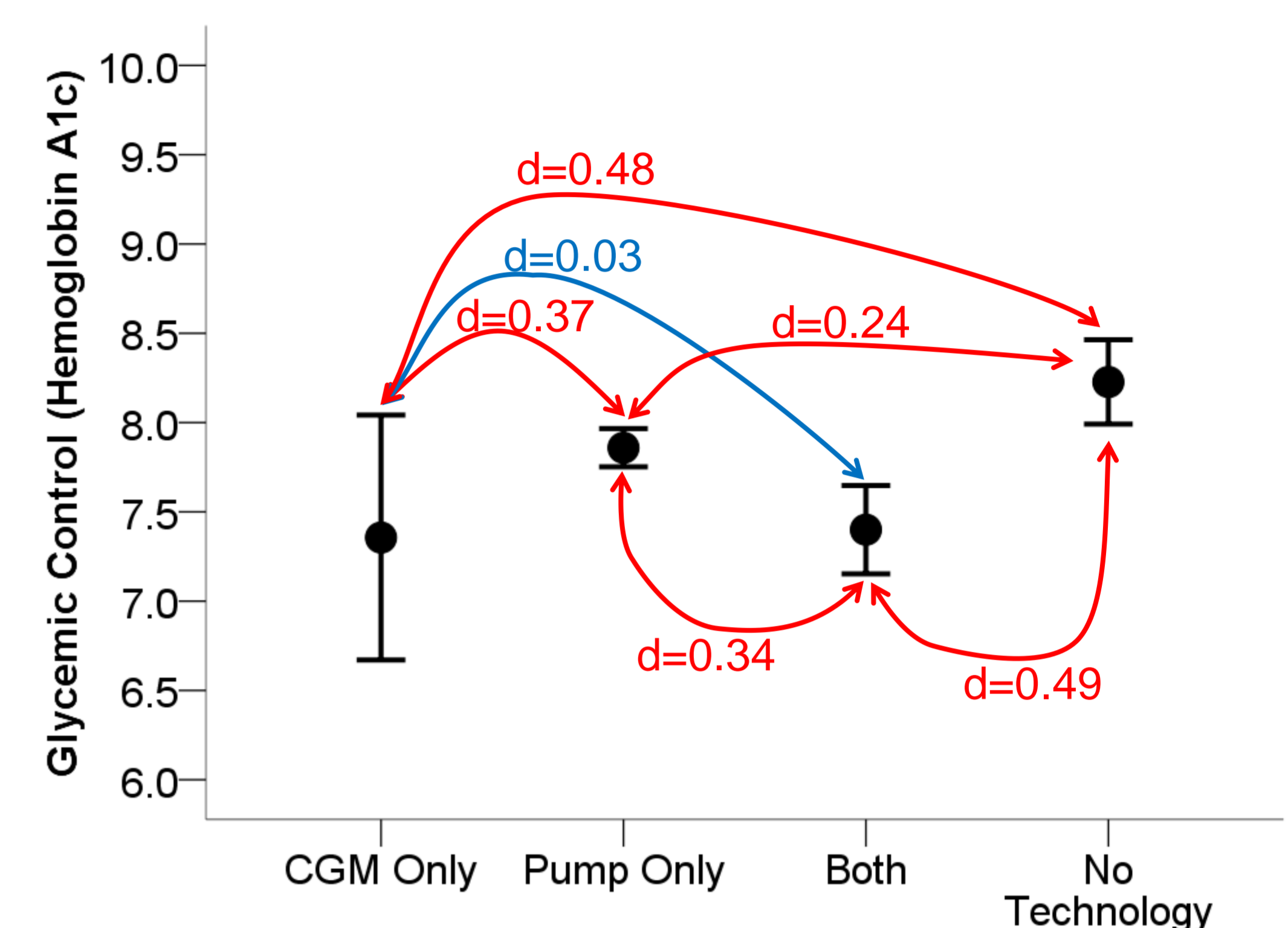
Conclusions

- Use of CGM alone or in combination with pump is associated with moderately lower hemoglobin A1c than not using technology.
- Using both technologies or CGM alone confers a small advantage on A1c over using pump alone ($d=0.34$ and 0.37 respectively)
- Use of CGM alone is moderately associated with both lower adolescent-reported and parent-reported diabetes distress than those using no technology
- CGM alone is associated with lower mean adolescent and parent distress relative to pump alone or using both technologies with small effect sizes (range of d : 0.26 – 0.29)

Results

Differences in Distress and A1c with Varying Technology Use

Figures below present means (black dots) and 95% confidence intervals (error bars) of reported distress and A1c values for each technology group. Effect size (d) < 0.20 between groups presented in blue in each figure. Effects ≥ 0.20 are in red.



Limitations/Future Directions

- Sample may not be representative of broader adolescent population living with type 1 diabetes
 - Mostly Caucasian and higher income families with married/cohabitating parents participated
 - Participants recruited from camps which may not represent the larger diabetes community
 - Sample characterized by low A1c values
- Sample sizes for technology use were variable and CGM alone only had $n=19$. Larger, evenly distributed sample sizes between groups may show different effects than those presented
- Future studies should further assess the unique benefits of CGM
- Further work in a large clinical sample to replicate findings would be beneficial