

# Program Evaluation of Camp Kudzu: Impact of Camp Attendance on HgA1C Levels in Adolescents

MARY KATHERINE WHITE, DNP, RN, CPNP

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KENNESAW STATE UNIVERSITY

WELLSTAR SCHOOL OF NURSING

# Introduction

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- Type I Diabetes Mellitus (T1DM) accounts for 10% of all diabetes cases

(Currie et al., 2013, Toussi et.al, 2008)

- T1DM is widely prevalent in the world, U.S. & GA and incidence is ↑

- 12.4% of U.S. population & 13.6% of Georgia's population lives with T1DM

(Novo Nordisk, 2014)

# Background of the problem

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- U.S. has 5<sup>th</sup> highest incidence rate of T1DM in world with a rate of 22/100K

(Soltez et.al, 2009)

- 480K children currently live with T1DM worldwide

- 76K new diagnoses/yr, ↑incidence 3%/yr

(Soltez et al., 2009)

- # youth in U.S. diagnosed ↑ 23% from 2001-2009

(Hino, 2013)

- T1DM is 3rd most common chronic illness in adolescents

(Skocic et al., 2012).

# Background of the problem

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- Complex treatment regimens
  - Diet, exercise, self blood glucose monitoring (SBGM), insulin administration  
(Skocic et al, 2012)
- Lack of proper treatment --> multiple complications  
(Currie et al., 2013)
  - Cardiovascular, neuropathy ,renal failure, premature death  
(Skocic et al., 2012, Carson, 2000)
  - Life expectancy is 20 yrs less for T1DM
  - Costs \$14.9 billion in U.S. annually  
(JDRF, 2014)

# Background of the problem

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- Non-adherence complications are the leading cause of kidney failure, non-traumatic limb amputations and blindness, major cause of heart disease and stroke, and 7<sup>th</sup> leading cause of death in the U.S.

(CDC, 2011)

- Adherence predicts control --> 26% ↓ in complications and good outcomes are ↑ 3x

(Markowitz et al., 2011, Taddeo et al., 2008)

# Background of the problem

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- Non-adherence ↑ in adolescents more than any other age  
(Borus & Laffel, 2010)
  - Pressures that influence acceptance and maintenance of T1DM  
(Carson, 2008)
  - Peer acceptance
  - ↓ SBGM
  - Overprotective parents
  - Denial
  - Anxiety/Depression



# Monitoring T1DM control?

- **HgA1C or A1C (%) →**

**approximate average BG over 2-3 month**

(Delamater, 2006)

- Objective, reliable measure of long term control

(Delamater, 2006)

- Dx <19 yrs <7.5, adolescents  $\leq$ 7.5

(ADA, 2014)

- **Endocrinologists' views**

- Range should be 6-7, <7.5 runs 5.5 - >14

A1C Level %	~Avg BG level (mg/dL)
5	97
6	126
7	154
8	183
9	212
10	240
11	269
12	298
13	326
14	355

# Problem Summary

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- Incidence of T1DM is ↑ at very high rates in the U.S.  
(Soltez et al, 2009)
- Incidence of T1DM in children in the U.S. is 22/100K  
(Soltez et al., 2009, Hino, 2013)
- Georgia has ↑ prevalence of T1DM than US  
(Novo Nordisk, 2014)
- Adolescents are most non-compliant age group  
(Taddeo et al, 2008, Carson, 2000)



# Diabetes Camps

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- Diabetes Camps are the ideal setting for continued diabetes education

(Wang et al., 2008, Garcia-Perez et al., 2010, Vicklund et al., 2007)

- Camp is effective at ↑ knowledge of self care, but weaker at showing a ↓ in A1C

(Hino, 2013, Wang et al., 2008)

- 30,000 children attend diabetes camps in the U.S.

(Hino, 2013)



# camp kudzu

We've Got Diabetes Covered!



[www.campkudzu.org](http://www.campkudzu.org)



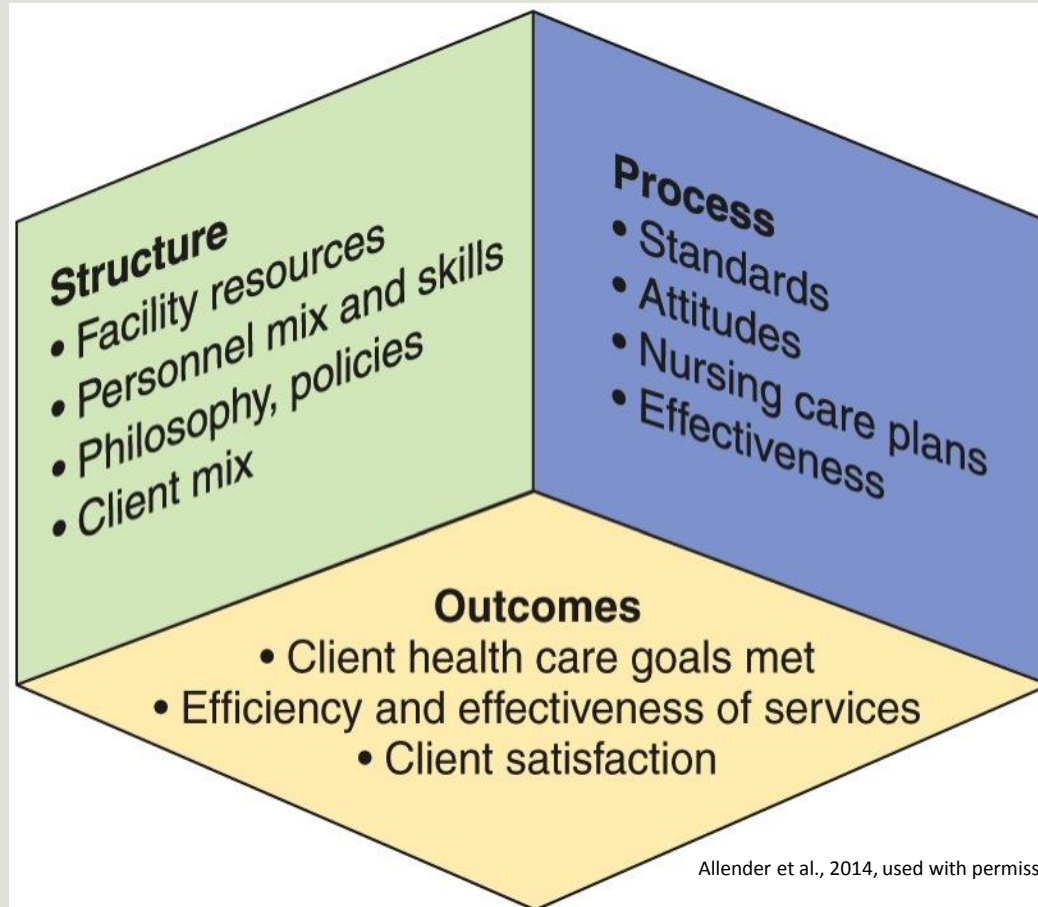
## **Mission:**

To educate, empower and inspire children living with diabetes

- There are some mechanisms to evaluate certain aspects of camp
- They are missing the part that all really want to know: Does camp attendance really impact campers' A1C?
- Is the education, empowerment and inspiration done at Camp Kudzu making a difference in the self-management of the campers?
- The BOD asked for this evaluation

# Conceptual Framework: Systems Model

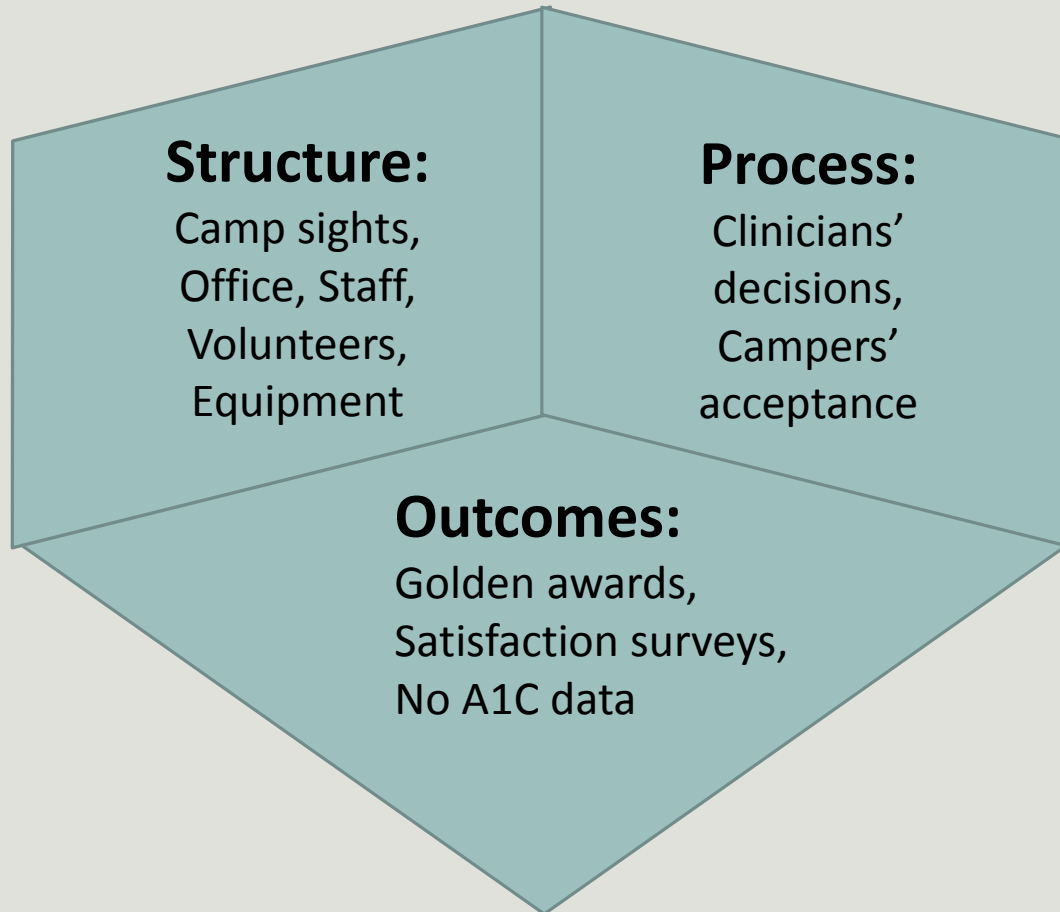
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Allender et al., 2014, used with permission

# Conceptual Framework: Systems Model

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# Literature Search

## Search Process

**Databases:** Ovid,  
PubMed, Cinhal

### Search Terms:

Adolescent, Diabetes Mellitus  
Type-1, Camp, Hemoglobin  
glycosylated

**Limits:** 2000- present,  
English, attendance at camp,  
A1C outcome

## Search Findings

### 10 articles

RCT -0

Quasi-Experimental – 9

Non-Experimental -1

## Level & Quality of Evidence

Quasi –  
Experimental (Level IV) –

6A, 3B, 1C

Non- Experimental  
(Level VI) –

1B

# Evidence Themes on Diabetes Camps

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## ■ **Formal Education** - Lecture

(Garcia-Perez et al., (2010), Semiz et al., (2000), Santiprabhob et al., (2008), Karaguzel et al., (2005), Winsett et al., (2010))

## ■ **Informal Education** - Discussion groups

(Garcia- Perez et al., (2010), Viklund et al., (2007), Santiprabhob et al.,(2008), Karaguzel et al., (2005))

**Physical Activity** (Huber et al., (2010), Ruznic et al., (2007))

**SBGM Frequency** (Haller et al., (2004), Santiprabhob et al., (2008))

## ■ **Empowerment** - Self-Esteem and Confidence

(Garcia-Perez et al., (2010), Santiprobhob et al., (2008), Wang et al., (2008), Kargruzel et al., (2005), Winsett et al (2010), Semiz et al., (2000))

## ■ **Inspiration** - Role Modeling

(Semiz et al., (2000), Karaguzel et al., (2005))

# Literature supporting Camp Kudzu

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- **Educate** - ↑ SBGM, ↑ Control, ↑ all types of education  
↑ short term control, evens with long term

(Garcia-Perez et al., (2010), Semiz et al., (2000), Santiprabhob et al., (2008), Karaguzel et al., (2005), Winsett et al., (2010), , Viklund et al., (2007), Huber et al., (2010), Ruznic et al., (2007), Haller et al., (2004)

- **Empower** - not effective or ineffective

(Garcia-Perez et al., (2010), Santiprobhob et al., (2008), Wang et al., (2008), Kargruzel et al., (2005), Winsett et al., (2010), Semiz et al., (2000)


- **Inspire** - Role modeling- effective – encouraged friendships and desires to return to camp

(Semiz et al., (2000), Karaguzel et al., (2005)



# Project Aims

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Describe the characteristics of adolescents attending Camp Kudzu and those not attending

Determine the impact of attending Camp Kudzu on the HgA1C levels of adolescents

Determine association of adolescents' demographics with HgA1C

# Methodology

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## **Type of project:**

A retrospective chart review using a Pre/Post format

## **Site:**

Camp Kudzu, 2 pediatric endocrinology practices

## **Participants:**

Adolescents 11-18 years old that attended Camp Kudzu in the summer of 2013 from two pediatric endocrinology practices and a matched sample on gender, age and practice that have never attended camp

# Methodology

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- Chart Review using a Pre/Post model
  - 12 month pre-camp average A1C
  - 2-4 month post camp *single* value A1C
  - 12 month post-camp average A1C
  - Non-campers used equivalent time periods
- GRU IRB reviewed and approved
- This study was not funded

# Demographics

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Variables		Campers (n=221)
<b>Age</b>	11-12 yrs	62 (31.31%)
	13-14 yrs	70 (35.35%)
	15-16 yrs	45 (20.73%)
	17-18 yrs	21 (10.61%)
<b>Gender</b>		88 (44.22%)
	Male	
	Female	111 (55.78%)
<b>Insurance</b>	Private	148 (74.37%)
	Medicaid	40 (20.10%)
	Peach Care	8 (4.02%)
	No Answer	3 (1.51%)

# Demographics

Variables		Campers (n=221)	Non-campers (n=203)
<b>Age</b>	11-12 yrs	62 (31.31%)	62 (31.16%)
	13-14 yrs	70 (35.35%)	71 (35.68%)
	15-16 yrs	45 (20.73%)	45 (22.61%)
	17-18 yrs	21 (10.61%)	21 (10.55%)
<b>Gender</b>	Male	88 (44.22%)	91 (45.73%)
	Female	111 (55.78%)	108 (54.27%)
<b>Insurance</b>	Private	148 (74.37%)	121 (59.61%)
	Medicaid	40 (20.10%)	65 (32.01%)
	Peach Care	8 (4.02%)	14 (6.9%)
	No Answer	3 (1.51%)	3 (1.48%)

# Demographics

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Variable		Campers (n=221)	Non-campers (n=203)
Insulin Delivery Pump		116 (52.49%)	69 (33.99%)
Shots		102 (46.15%)	129 (63.55%)
Date of Dx	<1 yr	25 (11.31%)	21 (10.34%)
	1-3 yrs	61 (27.6%)	68 (33.5%)
	4-6 yrs	50 (22.62%)	51 (25.12%)
	7-10 yrs	58 (36.24%)	36 (17.73%)
	>10 yrs	23 (10.41%)	14 (6.9%)

# Results: *Pre-Camp* A1C

Variable	Campers (n=221)	Non-Campers (n=203)	Mean Difference	p Value
<b>Age</b> 11-12 yrs	7.94	8.37	-0.43	0.066
13-14 yrs	8.26	8.49	-0.23	0.395
15-16 yrs	8.8	8.7	0.1	0.787
17-18 yrs	8.49	8.98	-0.49	0.291
<b>Gender</b> Male	8.34	8.36	-0.02	0.909
Female	8.25	8.71	-0.46	0.031

# Results: *Pre/Post* Camp A1C Levels

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Variable	<b>Campers</b> (n=221) <i>Pre-Camp</i> Mean	<b>Campers</b> (n=203) <u>Post-Camp</u> Mean	P-Value
A1C	8.29	8.34	0.462

\*Paired t-test

Variable	<b>Campers</b> (n=221) Mean	<b>Non-Campers</b> (n=203) Mean	P-Value
12 mo <i>Pre-Camp</i> Avg	8.29	8.55	0.084
2-4 mo <b>Post Camp</b>	8.30	8.27	0.887
12 mo <b>Post-Camp</b> Avg	8.34	8.59	0.112

\*Two sample t-test



# Results: Campers' Age: *Pre/Post* Camp A1C

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Age Range	<i>Pre-Camp</i> Avg Mean (SD)	<u>Post-Camp</u> Avg Mean (SD)	Mean Difference
11-12 yrs	7.94 (1.26)	8.09 (1.26)	0.15
13-14 yrs	8.26 (1.55)	8.44 (1.49)	0.18
15-16 yrs	8.8 (1.72)	8.56 (6.6)	-0.24
17-18 yrs	8.49 (1.22)	8.41 (0.92)	-0.08

# Results: Campers'/Non-campers' Age: *Pre/Post* Camp A1C

Age Range	<b>Campers</b> (n=221) <i>Pre-Camp Avg Mean (SD)</i>	<b>Non-Campers</b> (n=203) <i>Pre-Camp Avg Mean (SD)</i>	P Value
11-12 yrs	7.94 (1.26)	8.37 (1.46)	0.066
13-14 yrs	8.26 (1.55)	8.49 (1.64)	0.395
15-16 yrs	8.8 (1.72)	8.7 (1.78)	0.787
17-18 yrs	8.49 (1.22)	8.98 (1.68)	0.291

Age Range	<b>Campers</b> (n=221) <u>Post-Camp Avg Mean (SD)</u>	<b>Non-Campers</b> (n=203) <u>Post-Camp Avg Mean (SD)</u>	P Value
11-12 yrs	8.09 (1.26)	8.45 (1.65)	0.151
13-14 yrs	8.44 (1.49)	8.47 (1.51)	0.917
15-16 yrs	8.56 (6.6)	8.65 (2.11)	0.819
17-18 yrs	8.41 (0.92)	9.27 (2.01)	0.087

# Results: Campers' Gender: *Pre/Post* Camp A1C

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Gender	<i>Pre-Camp</i> Avg Mean A1C (SD)	<u>Post-Camp</u> Avg Mean A1C (SD)	Mean Difference
Male	8.34 (1.52)	8.41 (1.41)	0.07
Female	8.25 (1.47)	8.29 (1.36)	0.04

# Results: Campers' / Non-campers' Gender: *Pre/Post* Camp A1C

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Gender	<b>Campers</b> (n=221) <i>Pre-Camp Avg Mean(SD)</i>	<b>Non-Campers</b> (n=203) <i>Pre-Camp Avg Mean (SD)</i>	P Value
Male	8.34 (1.52)	8.36 (1.45)	0.909
Female	8.25 (1.47)	8.71 (1.75)	0.031

Gender	<b>Campers</b> (n=221) <u>Post-Camp Avg Mean (SD)</u>	<b>Non-Campers</b> (n=203) <u>Post-Camp Avg Mean (SD)</u>	P Value
Male	8.41 (1.41)	8.54 (1.45)	0.582
Female	8.29 (1.36)	8.63 (1.8)	0.108

# Results: Campers' Length of DX: *Pre/Post* A1C

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Date of Dx	<i>Pre-Camp</i> Avg Mean A1C (SD)	<u>Post-Camp</u> Avg Mean A1C (SD)	Mean Difference
<1 yr	7.87 (1.78)	7.98 (1.64)	0.11
1-3 yrs	8.08 (1.47)	8.28 (1.28)	0.2
4-6 yrs	8.4 (1.56)	8.47 (1.61)	0.07
7-10 yrs	8.43 (1.27)	8.44 (1.23)	0.01
>10 yrs	8.72 (1.51)	8.4 (1.24)	-0.32

# Results: Campers'/Non-campers' Length of Dx: Pre/Post A1C

Length of Dx	<b>Campers</b> (n=221) <i>Pre-Camp</i> Avg Mean (SD)	<b>Non-Campers</b> (n=203) <i>Pre-Camp</i> Avg Mean (SD)	P Value
<1 yr	7.87 (1.78)	8.84 (2.41)	0.141
1-3 yrs	8.08 (1.47)	8.02 (1.34)	0.811
4-6 yrs	8.4 (1.56)	8.7 (1.35)	0.32
7-10 yrs	8.43 (1.27)	8.84 (1.41)	0.16
>10 yrs	8.72 (1.51)	9.95 (1.89)	<b>0.05</b>

Length of Dx	<b>Campers</b> (n=221) <u>Post-Camp</u> Avg Mean (SD)	<b>Non-Campers</b> (n=203) <u>Post-Camp</u> Avg Mean (SD)	P Value
<1 yr	7.98 (1.64)	7.29 (1.37)	0.124
1-3 yrs	8.28 (1.28)	8.52 (1.83)	0.375
4-6 yrs	8.47 (1.61)	8.73 (1.48)	0.41
7-10 yrs	8.44 (1.23)	8.79 (1.45)	0.233
>10 yrs	8.4 (1.24)	10.06 (2.09)	<b>0.014</b>

# Results: Campers' Insulin Delivery: *Pre/Post* A1C

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Insulin Delivery	<i>Pre-Camp</i> Avg Mean A1C (SD)	<u>Post-Camp</u> Avg Mean A1C (SD)	Mean Difference
Pump	8 (1.1)	8.12 (1.05)	0.12
Shot	8.56 (1.75)	8.78 (1.74)	0.22

# Results: Campers' / Non-campers' Insulin Delivery: *Pre/Post* A1C

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Insulin Delivery	<b>Campers</b> (n=221) <i>Pre-Camp</i> Avg Mean (SD)	<b>Non-Campers</b> (n=203) <i>Pre-Camp</i> Avg Mean (SD)	P Value
Pump	8 (1.1)	8.07 (1.16)	0.713
Shot	8.56 (1.75)	8.78 (1.74)	0.359

Insulin Delivery	<b>Campers</b> (n=221) <u>Post-Camp</u> Avg Mean (SD)	<b>Non-Campers</b> (n=203) <u>Post-Camp</u> Avg Mean (SD)	P Value
Pump	8.12 (1.05)	8.27 (1.15)	0.368
Shot	8.78 (1.74)	8.81 (1.98)	0.249



# Results: Campers' # Yrs of Camp Attendance: *Pre/Post* A1C

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# Yrs at Camp	N	<i>Pre-Camp</i> Avg Mean (SD)	<u>Post-Camp</u> Avg Mean (SD)	Mean Difference
1 yr	47	8.5 (1.93)	8.45 (1.82)	-0.05
2-4 yrs	105	8.13 (1.43)	8.31 (1.32)	0.18
5-7 yrs	52	8.24 (0.91)	8.21 (1.02)	-0.03
8-10 yrs	14	8.93 (1.89)	8.59 (1.47)	-0.34
>10 yrs	1	8.3	8.7	0.4

# Results: Summary

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- >10 yrs length of dx for campers, post-camp A1C is 1.66 lower than non-campers with a net ↓ 0.4
- 8-10 yrs of camp attendance ↓ A1C 0.3
- Camp attendance has little affect on A1C

# Discussion

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- Other studies show a small ↓ in A1C at 3 mo post-camp, but returns by 12-mo post-camp
- This study showed no change at 2-4-mo post-camp single value and little to no change with 12-mo post camp average consistent with other studies
- Metformin ↓ A1C 0.6  
(Hurst et al., 2012)
- Limitations – 75% of participants were 11-14 yrs of age range in the pubescent stage, general stage of life of adolescents
- Future studies need to be done → look at older adolescents as well as the effect of camp attendance, as adolescents, on young adults' A1C

# Implications for practice

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- Camp attendance had little impact A1C levels
- Referrals of adolescents to diabetes camps are still appropriate
- Benefits of attending camp include ↑ knowledge of self management and finding emotional support through new friends and exposure to staff that function as role models

(Hino, 2013, Wang et al., 2008)

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