

2015

# Are New Sodium Targets in the National School Lunch Program Feasible and Are They Necessary?

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Philadelphia College of Osteopathic Medicine – Georgia Campus  
Biomedical Sciences

ARE NEW SODIUM TARGETS IN THE NATIONAL SCHOOL LUNCH  
PROGRAM FEASIBLE AND ARE THEY NECESSARY?

A Thesis in Biomedical Sciences by Yaneve Shemesh

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Submitted in Partial Fulfillment of the Requirements for the Degree of  
Master of Science in Biomedical Sciences  
May 2015

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## **Abstract**

In many societies, high salt intake is a continuing issue in adults, and is of growing concern in children due to the prevalence of processed foods. In response, the USDA has set three targets for sodium in meals offered in the National School Lunch Program (NSLP), and the National School Breakfast Program (NSBP). This 8-year goal is meant to decrease overall sodium levels in both meal programs. However, many associated with school nutrition ask if there is significant evidence to show what effect sodium plays on children's health, and thus determine if these targets are necessary or achievable. In addressing this question, a review of published articles was performed to determine the role of sodium in children's health. The review was followed by an analysis of sodium levels in food from the Cobb County School Nutrition Program (SNP). Data from the past 6 years was utilized to forecast future sodium levels and determine if the USDA's stated targets could be reached. In the review, it was determined that high sodium intake could negatively affect a child's blood pressure, contribute to the development of obesity, increase the likelihood of developing left ventricular hypertrophy, and contribute to further irritation of existing asthma. The Cobb County SNP reached the first sodium level target in July of 2014, and the data indicates the capability to reach the second target. However, the third target will prove more difficult to achieve.

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## Introduction

Excess sodium intake is evident in American society and is just as apparent in many other first world countries [1, 2]. In most American adults and children, there is much evidence to indicate significant sodium intake levels in comparison to average dietary recommendations. There is overwhelming support upholding a connection between increased amounts of salt in a person's diet and the development of hypertension in adults. This increased sodium intake results in several types of cardiovascular diseases (CVD) such as heart failure, ischemic stroke, aortic aneurysm, atherosclerosis, or pulmonary embolism [3, 4].

According to analyzed National Health and Nutrition Examination Survey (NHANES) data [5], children and adolescents consume as much sodium as adults, on average consuming 3,279 mg of sodium daily. Data also shows that 90 to 94% of American children and adolescents consume above the dietary recommended levels of salt as defined by the National Institute of Medicine (1,500 mg/day for ages 1-3 years old; 1,900 mg/day for ages 4-8; 2,200 mg/day for ages 9-13; and 2,300 mg/day for ages 14 and older) [2, 6]. Of the amounts consumed, adolescents in the ages of 14-18 consumed the most sodium out of any age group. Many factors contribute to this high sodium intake, but processed food found on grocery store shelves, fast food and restaurant meals, and pizza contribute the most sodium per calorie of food. It has been reported that 9% of sodium consumed by children ages 6-18 comes from the school cafeteria. According to Cogswell's analyses of 568 children that said they consumed a school lunch offered by the National School

Lunch Program (NSLP) in a 24-hour dietary recall, 26% of their daily sodium intake came from their school lunch.

Although sodium intake is high among children and adolescents, the connection of sodium intake to the development of chronic disease such as hypertension and CVD is less evident in this demographic [7]. While it is thought that evidence for decreasing sodium consumption in children and adolescents is not substantial, the United States Department of Agriculture (USDA) has decided to change nutrient standards, which include sodium levels, in food offered to children and adolescents at school.

The National School Lunch Program is essential in providing lunches to as many as 31 million participating students in 100,000 public and non-profit private schools a day. Because participants consume 40% of their caloric intake at lunch [8, 9], the NSLP plays a vital role in providing nutritionally adequate diets to school-aged children and adolescents. In the past, the NSLP meals contained excessive amounts of saturated fat, fat, and sodium [10]. In 2010, the Obama administration, spearheaded by first lady Michelle Obama as part of her "Let's Move!" initiative, introduced the Healthy, Hunger-Free Kids Act of 2010 [11, 12]. This act produced policy that dramatically changed the nutrition standards of the NSLP, the National School Breakfast Program (NSBP), the Summer Food Service Program, and the Child and Adult Care Food Program, as well as any other non-program food or beverage offered on public school property [13].

Studying sodium levels in the National School Lunch Program is interesting due to the decrease of sodium to the final proposed levels set to occur gradually

over the next eight years in comparison to other guidelines that are in effect as of the 2013-2014 school year. Starting July 1, 2014, the USDA has implemented sodium targets that must not be exceeded, ranging from 1,230mg – 1,420mg depending on the level of schooling [14]. The USDA have set sodium levels in tiered format to try and initiate a gradual decrease of sodium levels to help reach the goal of 2,300mg daily intake of sodium for adolescents 14 and older, 2,200 mg daily intake for children ages 9-13, and 1,900 mg daily intake for children ages 4-8. This amounts to a 40% decrease from current intake levels [4, 14]. The tiers targeted by the USDA are dependent on the level of schooling of the student (K-5, 6-8, and 9-12). The first target, as mentioned above, is a suggested range of 1,230mg – 1,420mg as of 2014. The second target, set for July 1, 2017, is 935mg – 1,080mg, and the final target, to be reached by July 1, 2022, is 640mg – 740mg [14]. As well as setting sodium targets for the NSLP, the USDA has implemented policy that will require food sold on school campuses, but outside the school meal program, to contain no more than 200mg of sodium for a snack item and no more than 480mg of sodium for an entrée item [15].

Some questions arise from the implementation of this policy to reduce sodium in the NSLP so dramatically. First, what are the effects of sodium on child or adolescent health? We know that high sodium diets in adults may lead to hypertension, making heart disease or stroke more likely [3], but does the same likelihood of developing such disease occur in children and adolescents who ingest high levels of sodium? To answer this question, I performed a literature review to determine if it is beneficial to children to have diets with lower sodium levels.

Second, is it possible to reach the USDA-suggested sodium targets? In addressing this, I examined sodium levels in the Cobb County School Lunch Program before and after the implementation of the first sodium targets set by the USDA in July 2014.

Lastly, what are the costs and benefits of reducing sodium levels in the NSLP? I followed the data analysis from Cobb County SNP by determining the cost and comparing the benefits of reducing sodium in the NSLP.

## **Literature review of sodium's effect on child and adolescent health**

Excessive sodium intake is associated with the development of hypertension in adults. Hypertension can lead to the further possibility of developing CVD. The effects of sodium on children are less studied, but are more frequently portrayed as having an effect on blood pressure, left ventricular hypertrophy, obesity, and asthma, some of which can lead to cardiovascular disease.

### **Blood pressure**

One of the major concerns with excessive salt intake is hypertension. In 55 studies performed across the world, it was determined that the prevalence of hypertension in adolescents is as high as 11.2 %. Of this number, there is a 13% prevalence in boys and 9.6% prevalence in girls [16]. Hypertension in children and adolescents of African American, Caucasian, and Hispanic descent in the United States rose in recent years, with a greater incidence in African Americans, Hispanics, and obese children [17]. It is worth noting that research led by McCarron showed a decrease in blood pressure when looking at NHANES data from the past 50 years [18]. However, this decrease was associated with a population of children, adolescents, and young adults examined as a whole. Studies done on children represented in NHANES data from the 60's, 70's, and early 80's show a decrease in blood pressure, but research analyzing data from later years shows that the decrease is becoming less substantial. Nonetheless, a decline of 0.65 and 0.23 mmHg for systolic and diastolic blood pressure respectively was reported among children

and adolescents. Admittedly, these numbers were not significant according to McCarron, but could demonstrate clinical importance due to the amplification of blood pressure with age. Yet, the possibility of a plateauing or reversing of this trend is conceivable, and so the need to exercise prevention is emphasized by McCarron.

Even though the trend of hypertension in children and adolescents may be plateauing or on the rise, there is still disagreement from commentators in school districts and by child nutrition consultants on the USDA's final proposed nutrition standards. Detractors argue that there is not enough scientific evidence to support the idea that sodium intake is linked to health issues in children or adolescents [14]. Yet, the reduction in sodium is frequently associated with the control of hypertension in the adult population. Contrary to the commentators' beliefs, there is a substantial amount of literature on the topic on sodium consumption in children and adolescents related to the development of hypertension and leading to the possible development of disease [19-21]. In a meta-analysis of 10 controlled trials equaling 966 participants, with a median age of 13, ranging from 8 to 16 years old, there was an overall decrease of blood pressure with a net salt reduction of 42% (interquartile range: 7% to 54%) [19]. He and MacGregor found an overall decrease of -1.17 mm Hg (95%: -1.78, -0.56) on systolic readings and a -1.29 mm Hg (95%: -1.94, -0.65) decrease on diastolic readings. A more recent meta-analysis of nine controlled studies performed by Aburot et al. found similar results in reduction of blood pressure when sodium intake was decreased, showing a systolic blood

pressure decrease of 0.84 mmHg (0.25 to 1.43 mmHg), and diastolic blood pressure decrease of 0.87 mmHg (0.14 to 1.60 mmHg) in eight of the nine controlled studies [21]. 10 studies reviewed and compared by the WHO in 2012 showed results which aligned with He et al. and Aburot et al., reaching a general result emphasizing a decrease in blood pressure for both systolic and diastolic readings when sodium intake was decreased [22].

Urinary sodium excretion has been related to the development of high blood pressure and is thought to be the most accurate method in order to determine sodium intake, even when controlling for weight, sex, age, height, and pulse [23]. Yet, trying to reproduce the same result proved to be difficult in later studies by the same author [24]. Two separate studies conducted support Cooper's, original claim of a correlation between urinary sodium excretion and high blood pressure in adolescents and children [25] and in young females [26]. It is worth noting that many of the studies on the topic of sodium effects on children and adolescents suffer from several methodological issues such as measurement of sodium intake, procedure for measuring of blood pressure, and inadequate sample size, leading to mixed findings when comparing studies [19, 27].

Another issue that adds a significant variability to the measurement of blood pressure in children and adolescents is the response that each individual has to sodium intake. There is considered to be variability in blood pressure response between normal individuals and individuals who are salt sensitive [27]. This is

especially apparent in individuals of African-American and Mexican-American ethnicity, those who are obese, individuals with a family history of hypertension (indicating a genetic relationship), and children who exhibit low and high birth weight [28-30]. Mu et al. showed the long-term impact of salt sensitivity on blood pressure in a cohort study. Mu compared a group of children who were salt sensitive and a group who were not salt sensitive; 15.5% of the salt sensitive group developed hypertension 18 years later compared to 6.3% of group who were not considered salt sensitive [31]. It is important to recognize that there is no set standard for determining salt sensitivity. Often, in studies where salt sensitivity is determined, extreme changes in salt intake are usually introduced [27]. No set standards can have an impact on determining salt sensitivity in individuals and thus deviate results.

Further studies analyzed sodium intake in children and adolescents. These studies focused on reducing sodium intake in children and adolescents, and how that reduction affects blood pressure. As mentioned above, sodium intake is high among U.S. children [2], and related studies agree that sodium consumption is high among children and is almost in line with adult sodium consumption [32, 33]. When looking at reducing sodium intake and its effects on blood pressure, most articles agreed that there was a minor to significant decrease in blood pressure [19, 27, 34]. This is especially true for intervention studies [34]. In contrast, Gillum et al. found that a change in sodium intake by 40% didn't produce a significant decrease in systolic and diastolic blood pressure [35]. Yet, there were many flaws in the study;

half of the participants dropped out before the completion of the study, and many participants struggled to keep proper food diaries or perform proper urine collections.

Infants and young children between the ages of 4 to 24 months have also been shown to ingest high levels of sodium [36]. According to Heird et al., infants between the ages of 4 to 5 months had a sodium intake 60% above the Dietary Reference Intake (DRI), and infants' sodium intake between the ages of 6 to 11 months was 33% above the DRI, while the 12 to 24 month old infants and toddlers had sodium intakes of 64% above the DRI. Heird went on to say that, although 4 to 5 month old infants had higher than recommended intake of sodium, reducing sodium in their diet would be difficult since most of their nutrition comes from mother's milk or formula (formula having similar amounts of sodium as mother's milk). In 6 to 24 month-old children, who start to get nutrients from home cooked and commercially available food, it becomes easier to control nutrient intake. The control of intake becomes more evident as young children start entering childcare, where federally funded programs have requirements that certain food groups be served, but have no regulation on this food meeting nutrient-based standards like in primary school food programs [37, 38]. Data gathered from childcare centers in Georgia by Maalouf et al. shows that the meals offered were high in saturated fat and sodium compared to the DRI recommendation [37]. While looking at the effect of sodium on the blood pressure of children and adolescents, He et al. also looked at studies examining sodium intake and its effect on blood pressure in infants [19].

The study shows that out of the 551 infants that had a median duration of salt reduction of 20 weeks, in which the median reduction of salt was 54%, the systolic blood pressure went down significantly (-2.47 mm Hg; 95% CI: -4.00 to -0.94); diastolic pressure was not measured. Although two of the studies were done in the 1980's when sodium concentrations were higher in formula milk than in mother's milk [39], it became apparent in a later study performed in Israel that there was the possibility that sodium content in tap water could be too high, especially coming from coastal sources such as desalination plants. When this water was mixed with formula powder, an increase in sodium intake was observed, in comparison to utilizing natural spring water [40]. According to Geleijnse et al., a form of tracking was evident; 35% of the infants from the Hofman et al. study showed a significant difference in blood pressure in those babies who were exposed to lower amounts of sodium compared to those that were not [41]. Geleijnse said that this could suggest a programming effect with salt intake in early life, leading to a higher chance of developing hypertension. Thus, breastfeeding and lower intake of salt at an early age could be beneficial [18, 41].

Although the results from the studies discussed may seem minimal, a sustained reduction in blood pressure in infancy, through childhood and into adolescence can have a profound effect on reducing the incidence of developing hypertension in adulthood and delaying the manifestation of chronic disease [42, 43]. Thus, sodium's important relationship to blood pressure becomes more concerning as blood pressure tends to track into adulthood [43, 44]. Chen et al.

found, in the meta-regression analysis of 50 cohort studies, the tracking of both systolic and diastolic blood pressure became more evident with increase in baseline age; the older the child or adolescent, the stronger the blood pressure tracked into adulthood [43]. Lee et al. studied tracking by following children over 24 years into young adulthood and found a strong correlation coefficient of blood pressure tracking [44]. Although there was a higher correlation coefficient in the 24-year study, subjects were only measured 14 times. Because of blood pressure irregularity, it can be argued that more blood pressure reading could increase the accuracy of the study [45].

### **Left ventricular hypertrophy**

More concerning still is the effect of sodium intake on the heart, specifically in left ventricular (LV) hypertrophy. LV hypertrophy or LV mass shows a correlation with systolic blood pressure and is thought to have a relationship with sodium intake in children and adolescents with essential hypertension [46], and is strongly associated with sodium intake in adults and the elderly [47, 48]. As well, there is an association between LV mass and atrial wall damage with increase in systolic blood pressure [49]; in contrast, the Bogalusa heart study found systolic blood pressure to be associated with LV wall thickness rather than LV mass[50]. What is more apparent is that LV mass or hypertrophy becomes more developed once hypertension has developed and although sodium may be a determinant of LV mass, according to Daniels et al., there has been limited evidence done with children and adolescents describing effects of salt intake association with LV mass. Yet, more

evidence of the link between salt intake and LV mass has been shown in adult and animal studies [47, 48, 51, 52].

## **Obesity**

Obesity is a major concern leading to many other health issues, and it has a prevalence of 18% in children ages 6-11 and 21% in adolescents ages 12-19 [53, 54]. Obesity results from an imbalance of calories consumed, where too many calories are consumed and not enough calories are utilized during normal activity [55]. Although a direct connection between salt intake and a higher chance of developing obesity has been less evident, there has been research to show that those who are obese and tend to be hypertensive will significantly benefit from a decrease in sodium in their diet [32]. Yang et al. showed that children who are overweight or obese have a 74% increased risk of becoming pre-hypertensive or hypertensive with every 1000mg increase in sodium intake, in comparison to 6% in normal weight children [32]. Trends observed by Din-Dzietham et al. show that the development of hypertension lags 10 years behind the development of obesity; thus, with the development of obesity there eventually comes the development of hypertension [17].

What is more apparent is the indirect link between salt and obesity. Higher sodium consumed leads to a higher fluid intake [56, 57]. For instance an increase in soft drink are well known to contribute to adult [58] and childhood obesity [59]. A study performed by He et al. showed that an increase in sodium consumption was related to an increase in soft drink consumption for children and adolescents

between the ages of 4 to 18. This increase in sodium consumption can relate indirectly to the development of obesity [60]. This was further supported with analysis of salt sales compared to the consumption of water from 1983 to 1998 done by Karppanen and Mervaala, showing an increase in salt sales of 55% during this period and was equivalent to the linear increase of water intake during the same period for adults aged 20 to 74 [61]. What is more interesting is that there was a 45% increase in soft drink consumption during the same period according to USDA data cited by Karppanen and Mervaala [62], contributing to the idea of sodium's indirect effect on increased energy intake and relating to the possible development of obesity. Thus, the development of obesity could lead to a restriction on sodium excretion for the first two decades in life resulting in increased stroke volume, cardiac output, and eventually blood pressure [63].

It is known that sodium consumption is a major aspect in determining fluid consumption. They are directly related such that decreased sodium intake leads to decreased fluid intake [57]. He et al. demonstrated that more than half of the drinks consumed by children and adolescents were sugar-sweetened soft drinks [60]. When salt consumption was cut in half for children and adolescents in the United Kingdom, there was an average reduction of two or greater sugar soft drink per week, or approximately 244 Kcal/week. In the long term, these results can influence the development of obesity on children and adolescents. Sodium, although not directly related to the development of obesity, is linked to increased

consumption of sugary drinks leading to weight gain. Obesity itself can then lead to the development of several serious chronic health conditions.

## **Asthma**

Asthma would not have been thought to be related to salt intake. Yet, there is evidence that shows a correlation between salt intake and asthma, particularly in children. Corbo et al. conducted a study with 20,016 children in Italy between the ages of 6 to 7, in which he asked questions about daily activity and diet [64]. One of the conclusive results showed a dose response relationship with sodium intake and the prevalence of asthma and/or wheezing. Another study supported a similar relationship in young adults with asthmatic symptoms. When given a high sodium diet, study subjects displayed an increase in the severity of inflammation to the airway passage upon initiating exercises or exercised-induced bronchoconstriction [65]. This is thought to occur due to increase in blood volume resulting in an increase in pulmonary venous and microvascular pressure, possibly leading to the development in pulmonary edema and decrease airway function. An older study determined that there is no relationship between usual salt intake and children diagnosed with asthma or exercised-induced bronchoconstriction when comparing cases and controls [66]. Studies could not be found regarding whether high salt intake could result in asthma or exercised-induced bronchoconstriction. Most studies looked at the effect that high salt intake has on asthma and exercised-induced bronchoconstriction; of these, no long-term studies could be found [67].

The evidence indicates that an abnormally high salt diet can contribute to aggravation of certain existing respiratory symptoms.

### **Cardiovascular disease**

Tracking of high blood pressure can result in hypertension in young adults leading to the early development of CVD, possibly resulting in early death [68-70]. Although it could be argued that higher sodium intake in children can lead to the possibility of developing hypertension, left ventricular hypertrophy, and contribute to Obesity, which can lead to many other chronic diseases; the connection between sodium intake specifically and CVD seems to be less evident in children and adolescents. The chance of developing CVD end up being higher for young individuals whom were obese, are pre hypertensive and/or have hypertension, or have increased Left ventricular mass index, which could be associated with salt intake [27, 71]. The possibility of sodium being indirectly associated with CVD seems more probable. As mentioned, there is substantial evidence of sodium corresponding with the developed of different types of disease. These different types of disease can then be linked to the increase likeliness of developing CVD in the general population, thus decreasing sodium in a diet may just decrease the burden of CVD on the general population, of which could include children and adolescents [71].

Hypertension in adults is very well known to make an individual more prone to CVD, but the risk of CVD in association with ingesting lower sodium amounts is

being challenged and articles have been published to show that when too little sodium is consumed, the resulting effect could be deleterious [72-75]. This led to the Institute of Medicine to hold a committee meeting and review all the available data and to recommended not going below 2300mg of sodium daily for the normal individual but still concluded that there is a significant relationship between consuming high levels of sodium and the development of cardiovascular disease [7, 76]. Yet, the Institute of Medicine noted that studies lack consistency and there was much variability and thus more evidence is needed to establish a proper healthy intake range. This has been shown for adult but not children or adolescences and thus more evidence needs to be attained in both populations.

### **Literature Review Summary**

It can be stated that ingesting large quantities of sodium is a prominent determinant of developing hypertension and can contribute to later development of disease. This can be confidently portrayed in young adults, middle age adults, and the elderly. In further discussing and researching the topic on children and adolescents, it can be understood that there is an effect of excess sodium consumption on a child's body, resulting in elevated blood pressure for both diastolic and systolic reading, as well as contributing to the development of left ventricular hypertrophy. More importantly, the effects can be amplified quite significantly with an overweight and/or obese child, while at the same time sodium can indirectly contribute to increasing the likely hood of developing problems in weight. It may not be agreed upon on how significant sodium's effect to a child's

health may be, but the evidence is there to support that there is an increased risk of some sorts, which could result in numerous consequences. Decreasing this risk must be tackled and it must be done through providing children and adolescents with not only low sodium alternatives, but with foods that have higher potassium and are more nutrient dense [77] Teaching children early on to better their diet so as that behavior of making better choices can be ingrained in their minds.

This review shows that it is necessary to decrease salt consumption not only in adults, but also in children so as to combat development of hypertension, reduce the risk of developing left ventricular hypertrophy, help combat obesity and reduce the risk for those who are obese in developing hypertension, lessen the aggravation of asthma, and prevent development of CVD in the future. The question being asked is how can we lower sodium in children's diets and provide healthy alternatives? One way this is being answered is with a complete overhaul to the nutrition being provided from at least one the more important and major source of food for many children and adolescents, the food items offered through public and private institutions. This is one of the major steps that are needed to help bring down the intake of sodium in the younger population of American.

## **Methods**

### **Literature review**

The literature was attained by searching on PubMed. The search was limited to publish English language literature involving human subjects and was reviewed through April 2015. Search terms/phrases include, but were not limited to, the following: “Sodium intake in children”, “Sodium intake in children and adolescents”, “Salt intake in children and adolescents”, “Sodium intake and cardiovascular disease in children”, “Sodium effect on hypertension in children”, “Hypertension in children”, “Sodium consumption in the national school lunch program”, “National School Lunch Program”, “Food waste in the national school lunch program”, etc. In addition to the search through PubMed, a review of the reference lists for selected articles was performed to acquire still more articles for a more comprehensive review of the literature.

### **Sodium level data**

The sodium level data were obtained from the Cobb County School Nutrition Program. It consists of sodium levels record as weekly averages for two weeks of the month (rotating the menu twice a month) and is separated into three sets by level of schooling (elementary or K-5, middle or 6-8, and high school or 9-12). These numbers consist of the average sodium level in school lunch program for one week. The numbers were recorded, calculated, distributed to me by the Cobb County School Nutrition Program. Six years of data was obtained from 2009 - 2010 school years to the 2014 - 2015 current school years.

## Results

The data shows a decrease of sodium levels in school lunches reaching levels of 820 mg with a standard deviation of 316.38, 745 mg with a standard deviation of 588.65, and 869 mg with a standard deviation 694.84 for schooling levels of K-5, 6-8, and 9-12 respectively (tables 3). Standard deviation (Table 3) in the parentheses was determined from the calculated average for both weeks for each level of schooling in each year of collected data (table 2). Level of schooling with the lowest decreasing slope in sodium levels was K-5 for each week (figure 1) and the average of the two weeks (figure 2), which was followed by 6-8 (figure 4 and 5), and 9-12 having the highest decreasing slope for each week (figure 7) and the average of the two weeks (figure 8).

The logarithmic regression determined the best-fit line and was determined by the R-value closest to one for both K-5 (figures 1 and 2) and 6-8 (figures 4 and 5). Schooling level 9-12 had an R-value closest to 1 when exponential regression was applied to the original data (figure 7) and the average of the two weeks (figure 8). R-values for the exponential and logarithmic regression are not significantly different (only differing by 0.06). Logarithmic regression was utilized for both the original data (figure 9) and the average of the two weeks (figure 10) for consistency with the other data previously mentioned above.

The forecast along with the standard deviation, which are represented by error bars, are depicted for each level of schooling in figures 3, 6, 11, and 12 for K-5, 6-8, 9-12, and all levels of schooling, respectively. These forecasts are determined by the logarithmic regression allowing values to be calculated for each of the schooling levels for each year up until the 2022-2023 school years (table 3).

### **Raw data**

Table 1 data was separated into three levels of schooling (K-5, 6-8, and 9-12) for each of the six years data was given. Average sodium levels were collected for two weeks out of the year due to the same food rotating every two weeks. Table 2 shows all the collected data from Table 1 along with the average value calculated for both weeks of the year for each level of schooling. Table 3 shows the raw data from each week and the average for each level of schooling. After the 6<sup>th</sup> year on Table 3, for each level of schooling, are the forecast values. In parentheses next to each value are the standard deviations calculated for each level of schooling.

Cobb county schools	School year 2009-2010 sodium weekly average			School year 2010-2011 sodium weekly average			School year 2011-2012 sodium weekly average		
	School level	Week	Sodium level (mg)	School level	Week	Sodium level (mg)	School level	Week	Sodium level (mg)
	K-5 (elementary)	Week 1	1249	K-5 (elementary)	Week 1	1256	K-5 (elementary)	Week 1	1133
		Week 2	1414		Week 2	1166		Week 2	984
		Week 3	n/a		Week 3	n/a		Week 3	n/a
		Week 4	n/a		Week 4	n/a		Week 4	n/a
	6th - 8th (middle)	Week 1	1860	6th - 8th (middle)	Week 1	1508	6th - 8th (middle)	Week 1	1598
		Week 2	1808		Week 2	1632		Week 2	1440
		Week 3	n/a		Week 3	n/a		Week 3	n/a
		Week 4	n/a		Week 4	n/a		Week 4	n/a
9th - 12th (high)	Week 1	1999	9th - 12th (high)	Week 1	1971	9th - 12th (high)	Week 1	1598	
	Week 2	1948		Week 2	2060		Week 2	1687	
	Week 3	n/a		Week 3	n/a		Week 3	n/a	
	Week 4	n/a		Week 4	n/a		Week 4	n/a	
School year 2012-2013 sodium weekly average			School year 2013-2014 sodium weekly average			School year 2014-2015 sodium weekly average			
School level	Week	Sodium level (mg)	School level	Week	Sodium level (mg)	School level	Week	Sodium level (mg)	
K-5 (elementary)	Week 1	957	K-5 (elementary)	Week 1	1122	K-5 (elementary)	Week 1	1062	
	Week 2	770		Week 2	1039		Week 2	1069	
	Week 3	n/a		Week 3	n/a		Week 3	n/a	
	Week 4	n/a		Week 4	n/a		Week 4	n/a	
6th - 8th (middle)	Week 1	1154	6th - 8th (middle)	Week 1	1179	6th - 8th (middle)	Week 1	1137	
	Week 2	1051		Week 2	1211		Week 2	1128	
	Week 3	n/a		Week 3	n/a		Week 3	n/a	
	Week 4	n/a		Week 4	n/a		Week 4	n/a	
9th - 12th (high)	Week 1	1648	9th - 12th (high)	Week 1	1219	9th - 12th (high)	Week 1	1284	
	Week 2	1428		Week 2	1161		Week 2	1230	
	Week 3	n/a		Week 3	n/a		Week 3	n/a	
	Week 4	n/a		Week 4	n/a		Week 4	n/a	

Table 1: Data collected from the Cobb County School Nutrition Program

School Years 2009-2015	K-5 - Week 1	K-5 - week 2	K-5 - Average	6-8 - week 1	6-8 - week 2	6-8 - Average	9-12 - week 1	9-12 - week 2	9-12 - average
1	1249	1414	1331.5	1860	1808	1834	1999	1948	1973.5
2	1256	1166	1211	1508	1632	1570	1971	2060	2015.5
3	1133	984	1058.5	1598	1440	1519	1598	1687	1642.5
4	957	770	863.5	1154	1051	1102.5	1648	1428	1538
5	1122	1039	1080.5	1179	1211	1195	1219	1161	1190
6	1062	1069	1065.5	1137	1128	1132.5	1284	1230	1257

Table 2: Sodium levels per week for each schooling level and the calculated averages of both weeks for each year.

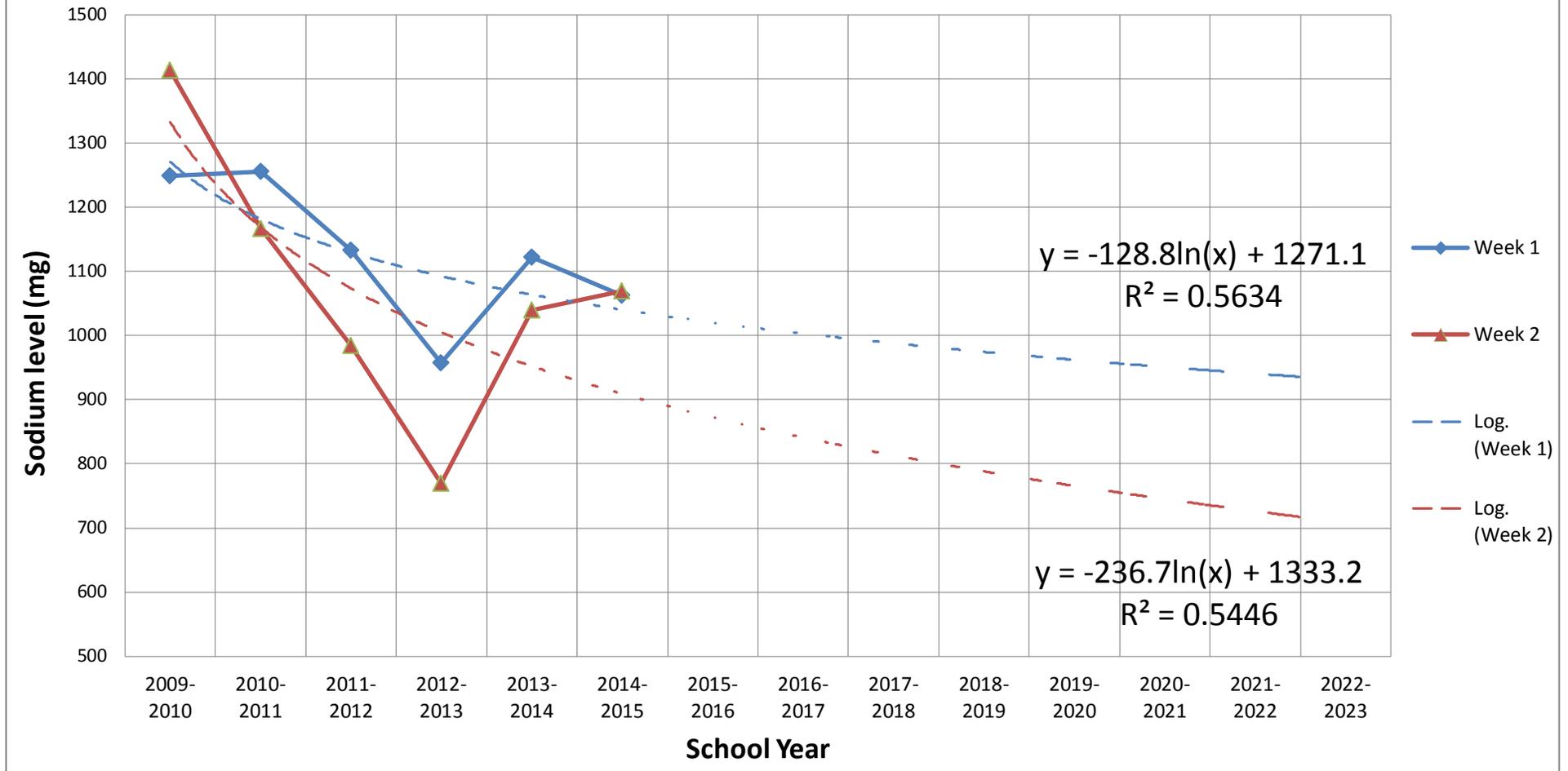
School Years 2009-2023	K-5 Week 1	K-5 week 2	K-5 Average and Forecast	6-8 week 1	6-8 week 2	6-8 Average and Forecast	9-12 week 1	9-12 week 2	9-12 average and Forecast
1	1249	1414	1331.5 (+- 316)	1860	1808	1834 (+- 589)	1999	1948	1973.5 (+- 695)
2	1256	1166	1211 (+- 316)	1508	1632	1570 (+- 589)	1971	2060	2015.5 (+- 695)
3	1133	984	1058.5 (+- 316)	1598	1440	1519 (+- 589)	1598	1687	1642.5 (+- 695)
4	957	770	863.5 (+- 316)	1154	1051	1102.5 (+- 589)	1648	1428	1538 (+- 695)
5	1122	1039	1080.5 (+- 316)	1179	1211	1195 (+- 589)	1219	1161	1190 (+- 695)
6	1062	1069	1065.5 (+- 316)	1137	1128	1132.5 (+- 589)	1284	1230	1257 (+- 695)
7			946.38 (+- 316)			1035.73 (+- 589)			1199.01 (+- 695)
8			921.97 (+- 316)			979.68 (+- 589)			1135.53 (+- 695)
9			900.44 (+- 316)			930.25 (+- 589)			1079.53 (+- 695)
10			881.18 (+- 316)			886.03 (+- 589)			1029.45 (+- 695)
11			863.76 (+- 316)			846.03 (+- 589)			984.14 (+- 695)
12			847.85 (+- 316)			809.51 (+- 589)			942.77 (+- 695)
13			833.22 (+- 316)			775.92 (+- 589)			904.72 (+- 695)
14			819.68 (+- 316)			744.81 (+- 589)			869.49 (+- 695)

Table 3: Forecast averages for each schooling level for the next 8 years.

## **K-5 analysis**

Figure 1 consists of the sodium level average for each week for the past 6 years. A logarithmic regression was performed for each week to attain an R -value and equation of the line. Figure 2 shows the average of the two weeks of sodium level data for each year and those values are plotted allowing to produce a logarithmic regression and give an equation. The equation was then utilized to forecast the values for the next 8 years in Figure 3. Each value in Figure 3 is denoted with an error bar within 2 Standard deviations ( $\pm 316$ ). Figure 3 as well has colored lines representing each target, blue denotes the first target, green denotes the second target, and red denotes the third target in order to compare the forecast to all three targets.

## Cobb County Sodium Weekly Average for lunch meals K-5 (Elementary School)



**Figure 1: K-5 average sodium levels for each week and their associated logarithmic regression.**

## Cobb County Sodium Average of the two weeks for lunch meals K-5 (Elementary School)

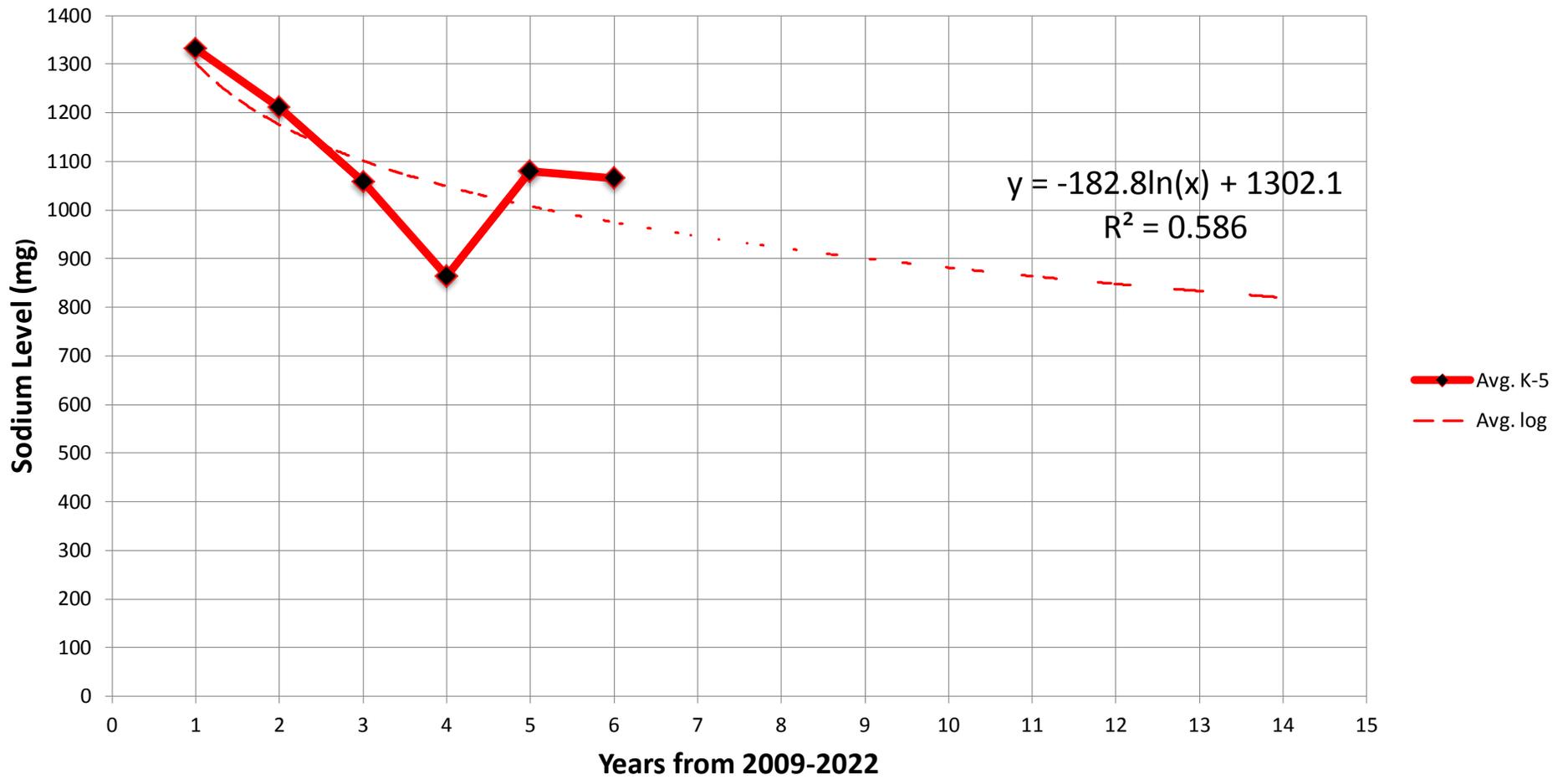


Figure 2: K-5 calculated average sodium levels for both weeks for each year of collected data and their associated logarithmic regression.

## Cobb County Sodium Average and Forecast of the two weeks for lunch meals

### Error bars within $2\sigma$

### K-5 (Elementary School)

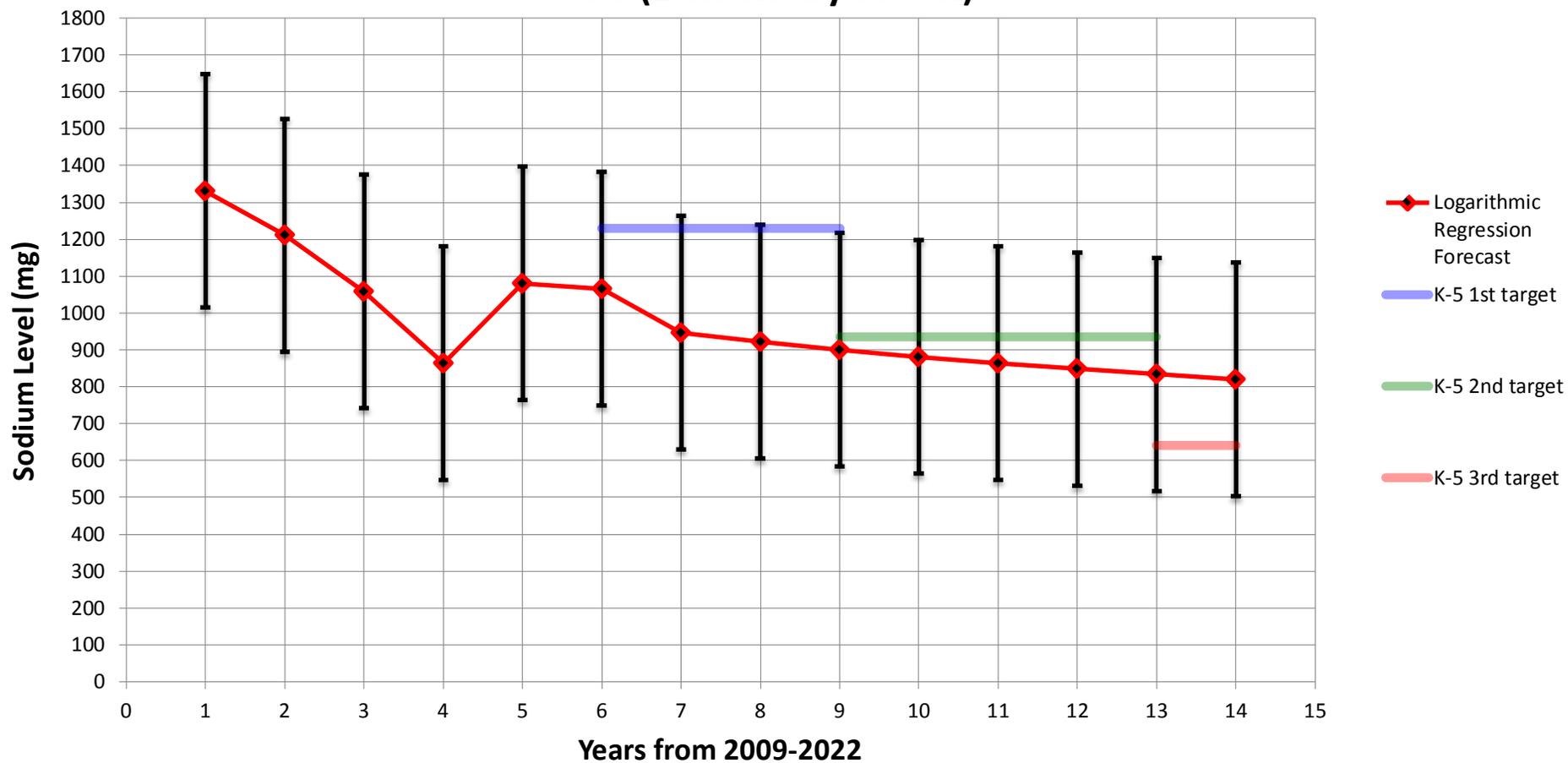


Figure 3: K-5 logarithmic regression forecast with error bars inside  $2\sigma$ .

## **6-8 analysis**

Figure 4 consists of the sodium level average for each week for the past 6 years. A logarithmic regression was performed for each week to attain an R - value and equation of the line. Figure 5 shows the average of the two weeks of sodium level data for each year and those values are plotted allowing to produce a logarithmic regression and give an equation. The equation was then utilized to forecast the values for the next 8 years in Figure 6. Each value in Figure 6 is denoted with an error bar within 2 Standard deviations ( $\pm 589$ ). Figure 6 as well has colored lines representing each target, blue denotes the first target, green denotes the second target, and red denotes the third target in order to compare the forecast to all three targets.

### Cobb County Sodium Weekly Average for lunch meals 6th - 8th (Middle School)

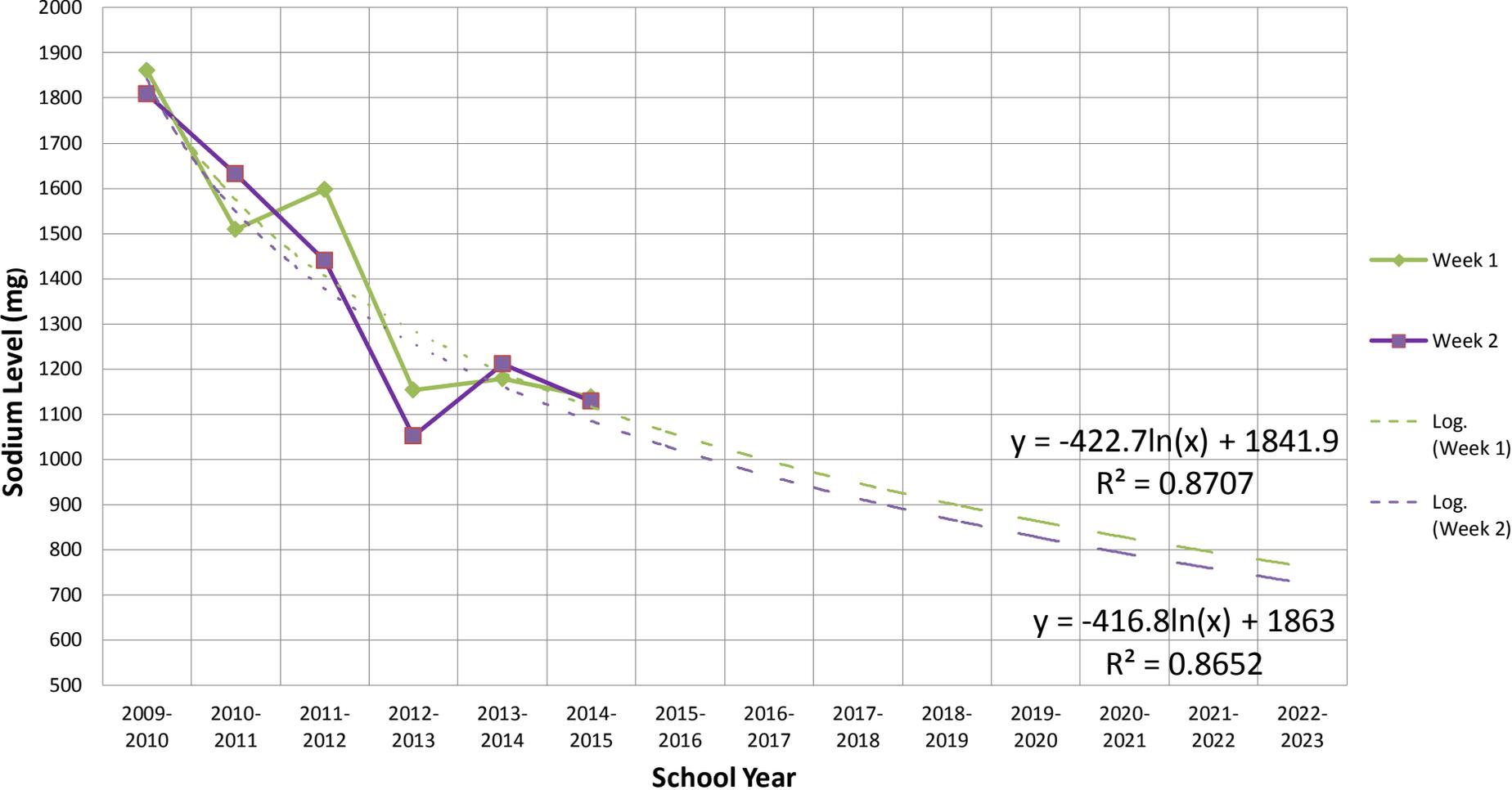


Figure 4: 6-8 average sodium levels for each week and their associated logarithmic regression.

### Cobb County Sodium Average of the two weeks for lunch meals 6-8 (Middle School)

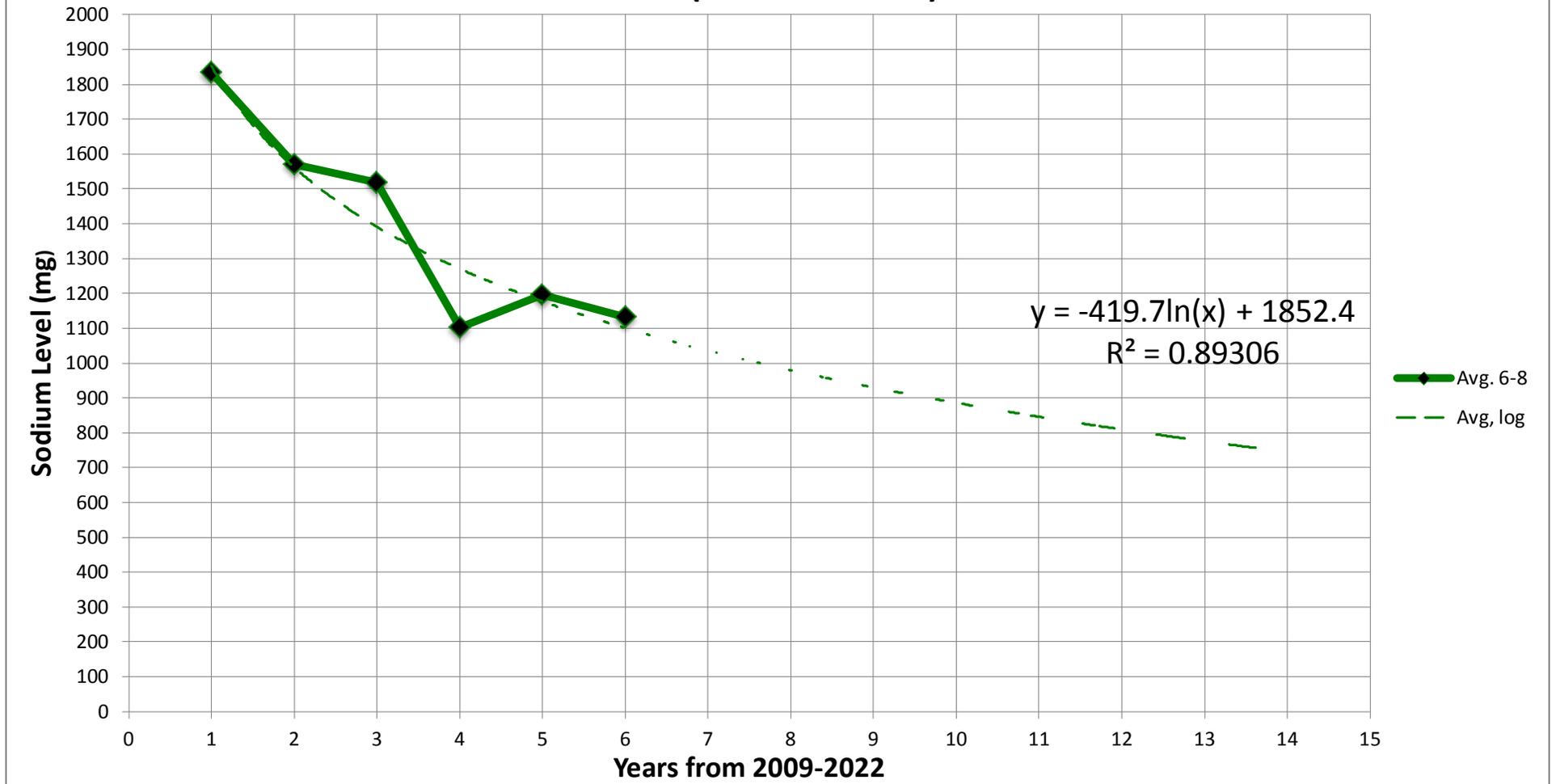


Figure 5: 6-8 calculated average sodium levels for both weeks for each year of collected data and their associated logarithmic regression.

## Cobb County Sodium Average and Forecast of the two weeks for lunch meals

### Error bars within $2\sigma$ 6-8 (Middle School)

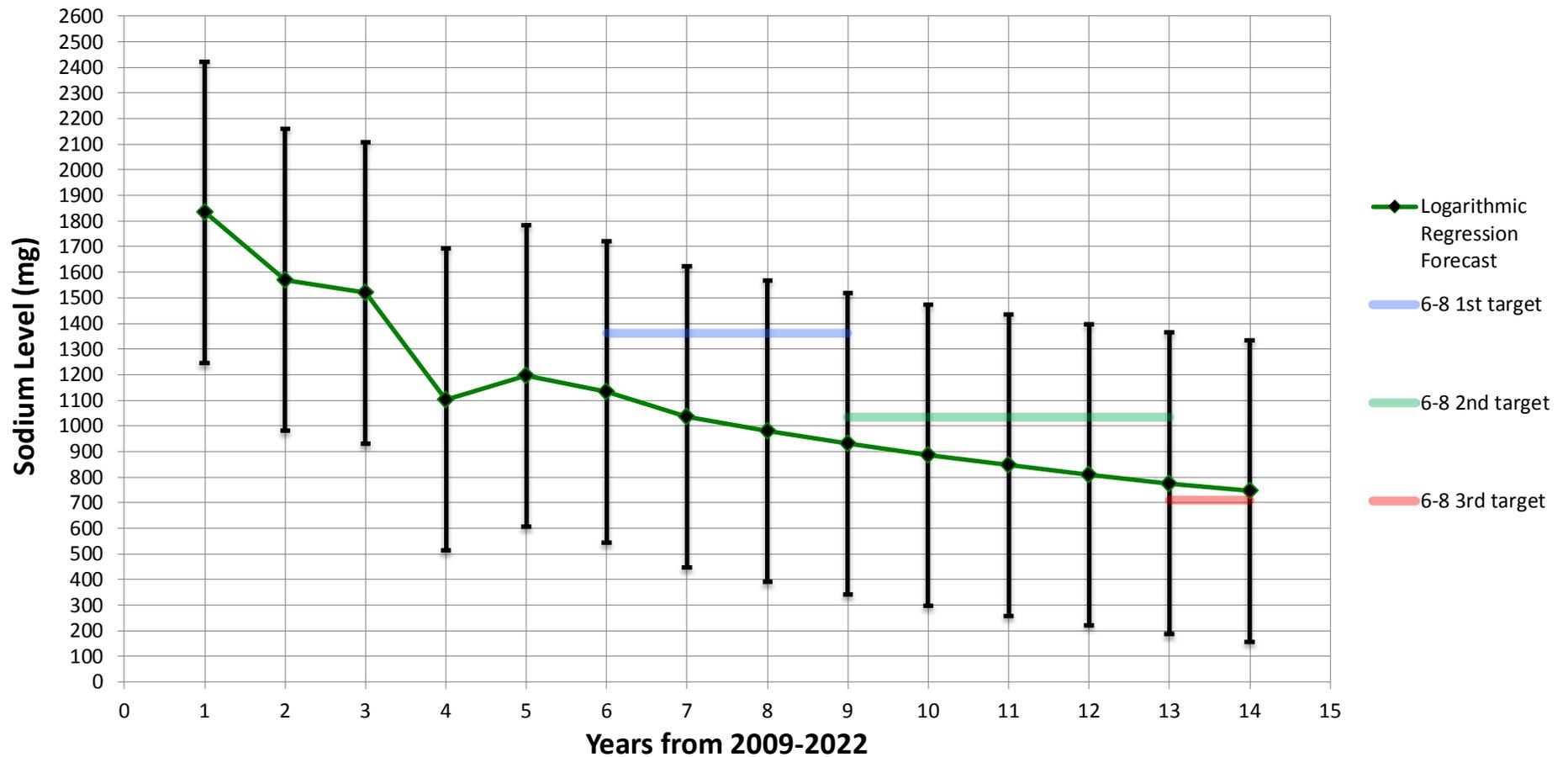


Figure 6: 6-8 logarithmic regression forecast with error bars inside  $2\sigma$ .

## 9-12 analysis

Figure 7 consists of the sodium level average for each week for the past 6 years. An exponential regression was performed for each week to attain an R -value and equation of the line. Figure 8 shows the average of the two weeks of sodium level data for each year and those values are plotted allowing to produce an exponential regression and give an equation. Figure 9 is the same as Figure 7 but a logarithmic regression was performed rather than exponential regression. Figure 10 is the same as Figure 8 but again; a logarithmic regression was performed rather than exponential regression. The equation from the logarithmic regression was then utilized to forecast the values for the next 8 years in Figure 11. Each value in Figure 11 is denoted with an error bar within 2 Standard deviations ( $\pm 695$ ). Figure 11 as well has colored lines representing each target, blue denotes the first target, green denotes the second target, and red denotes the third target in order to compare the forecast to all three targets. Figure 12 shows all levels of schooling graphed on one chart to see how they compare to each other.

## Cobb County Sodium Weekly Average for lunch meals 9th-12th (High School)

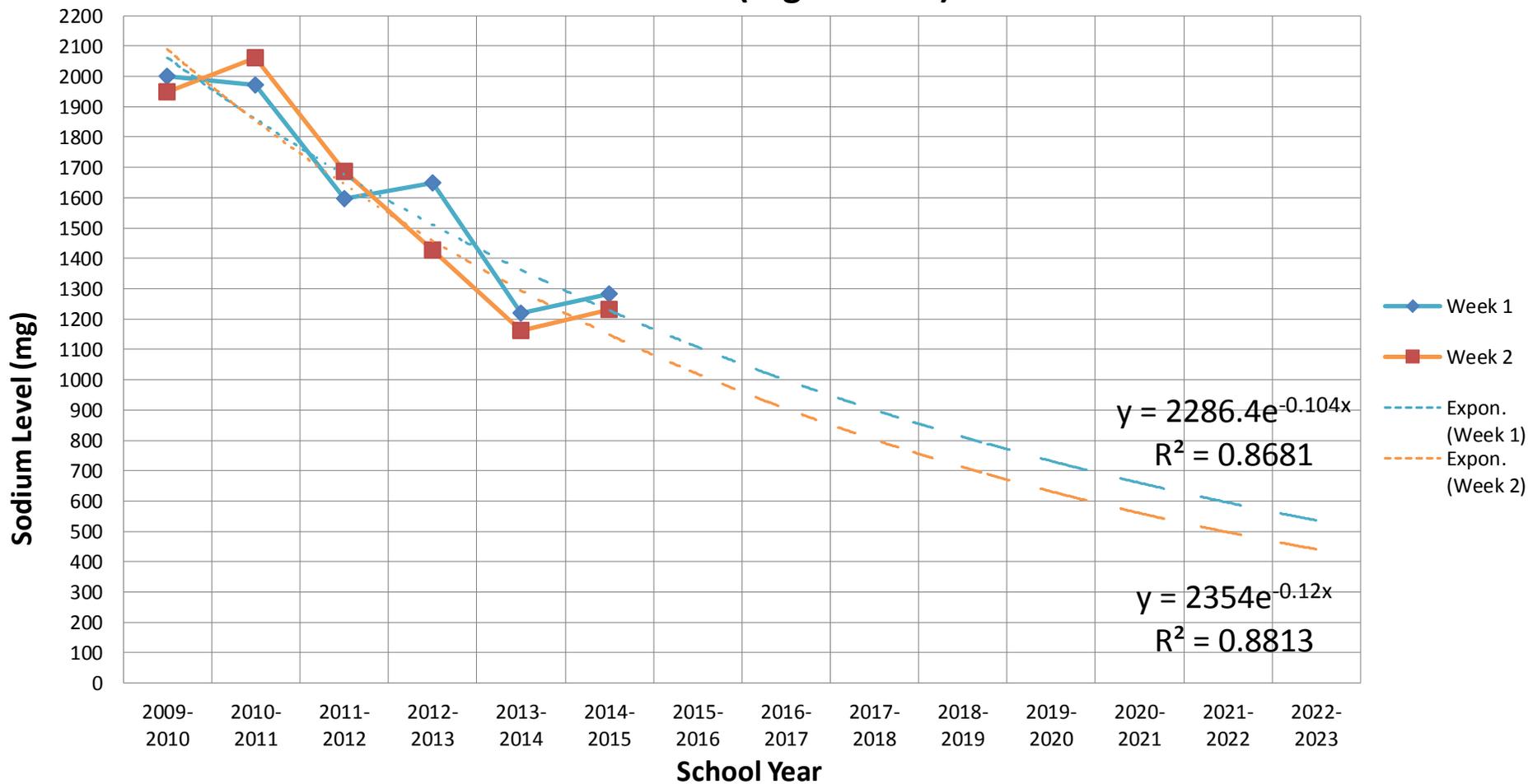
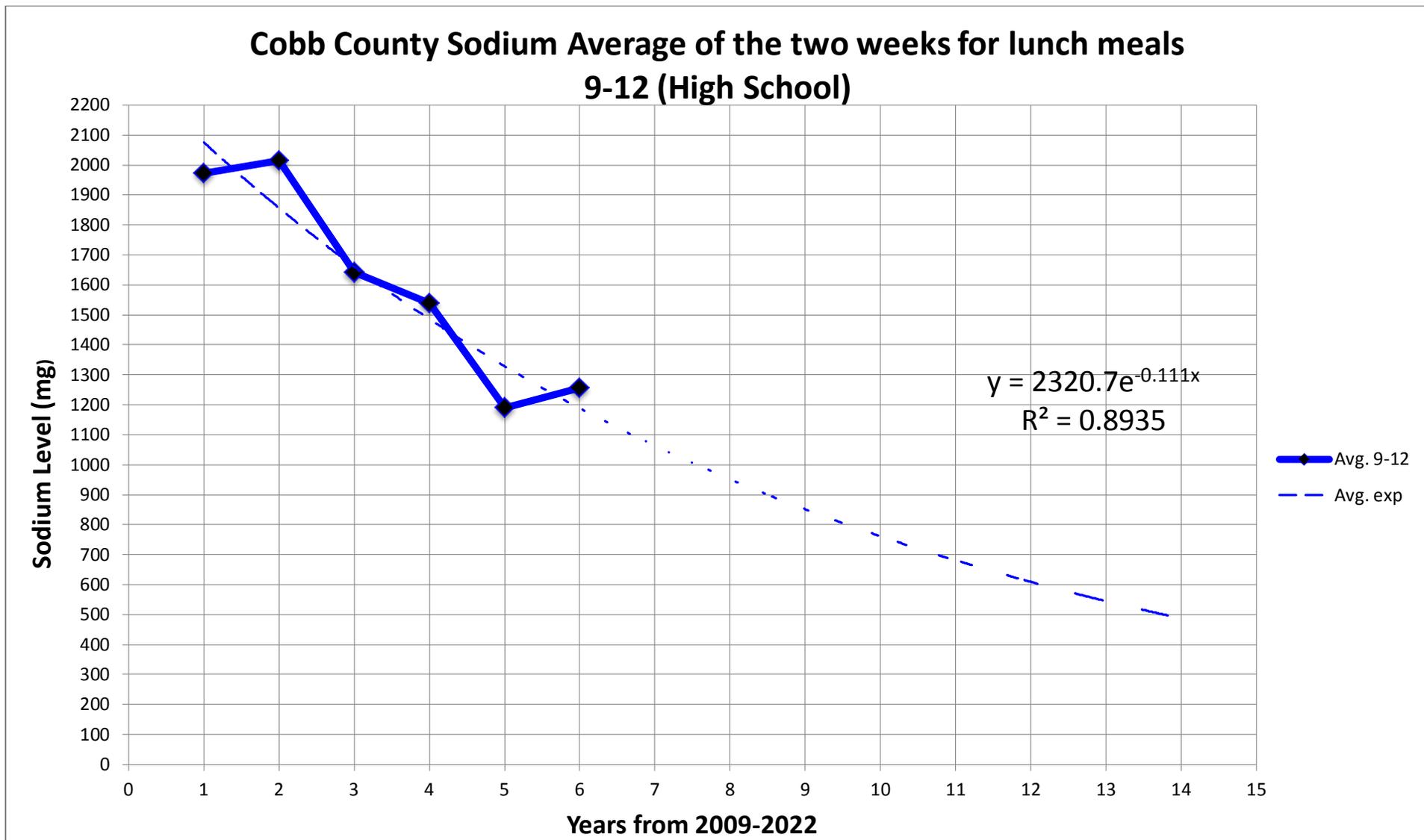


Figure 7: 9-12 average sodium levels for each week and there assciated exponetial regression.



**Figure 8: 9-12 calculated average sodium levels for both weeks for each year of collected data and their associated exponential regression.**

## Cobb County Sodium Weekly Average for lunch meals 9th-12th (High School)

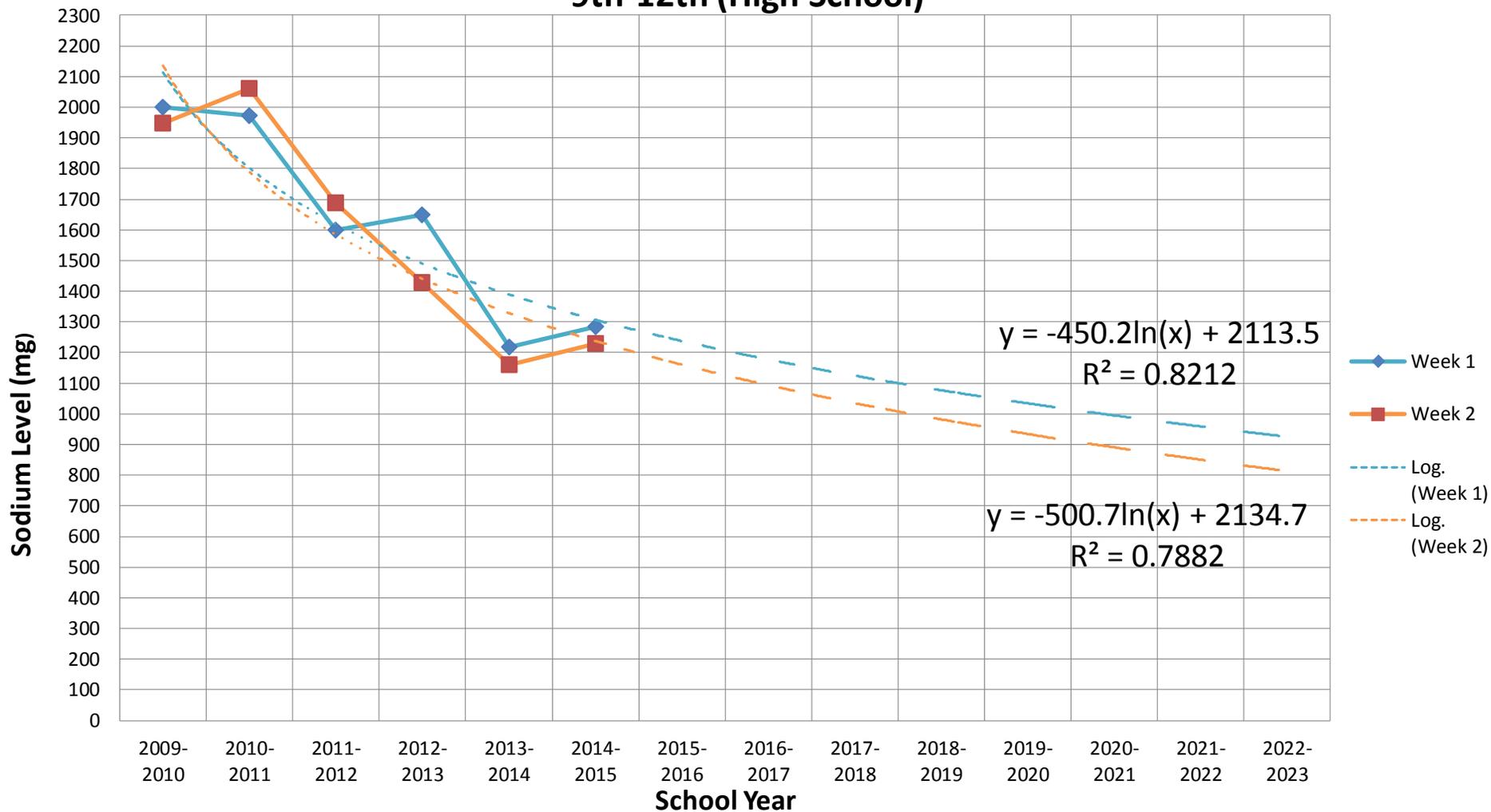


Figure 9: 9-12 average sodium levels for each week and there assciated lograthmic regression.

### Cobb County Sodium Average of the two weeks for lunch meals 9-12 (High School)

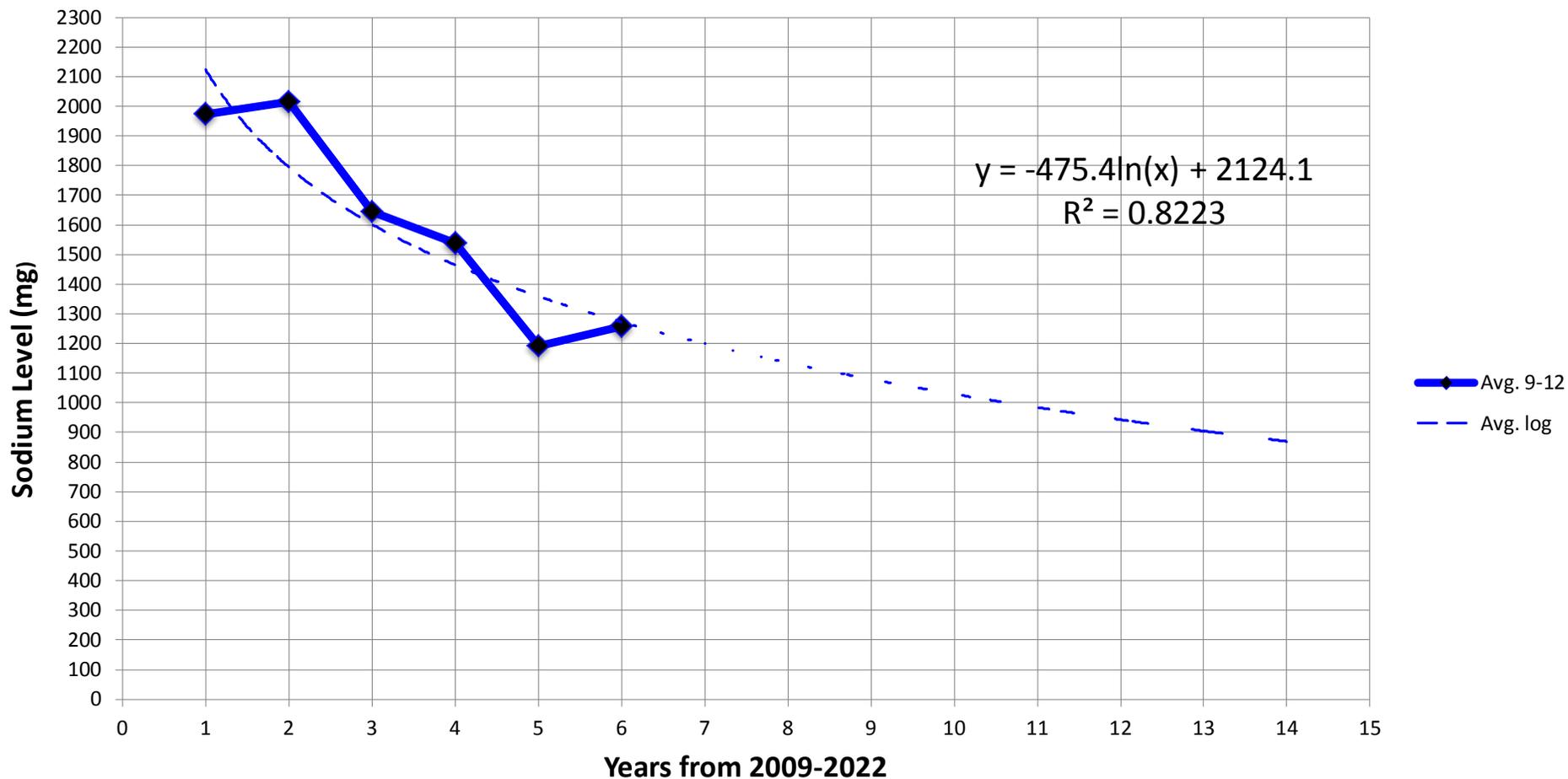


Figure 10: 9-12 calculated average sodium levels for both weeks for each year of collected data and their associated logarithmic regression.

## Cobb County Sodium Average and Forecast of the two weeks for lunch meals

### Error bars within $2\sigma$ 9-12 (High School)

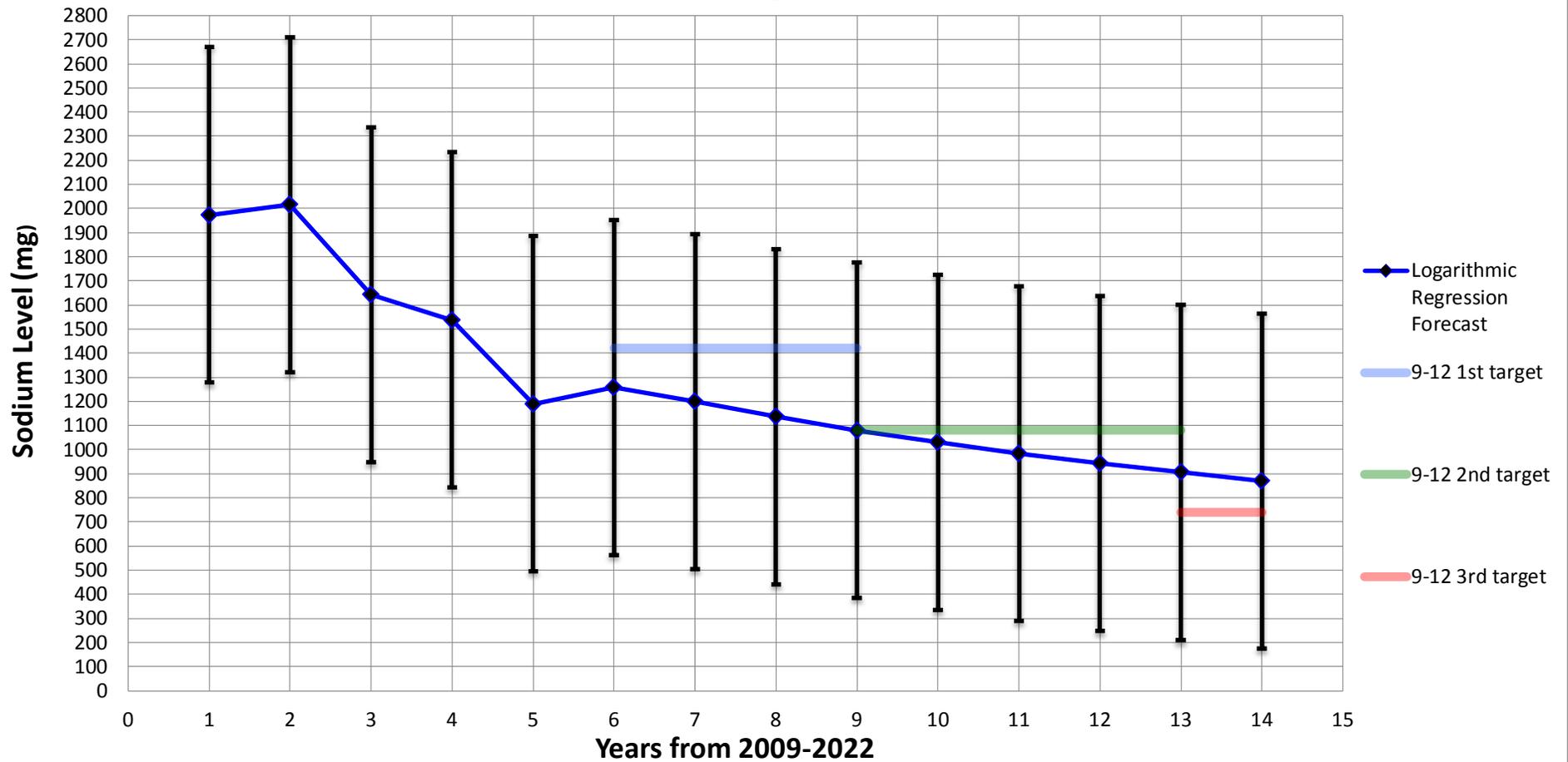


Figure 11: 9-12 logarithmic regression forecast with error bars inside  $2\sigma$ .

## Cobb County Sodium Average and Forecast of the two weeks for lunch meals

### Error bars within $2\sigma$

### All Schooling Levels

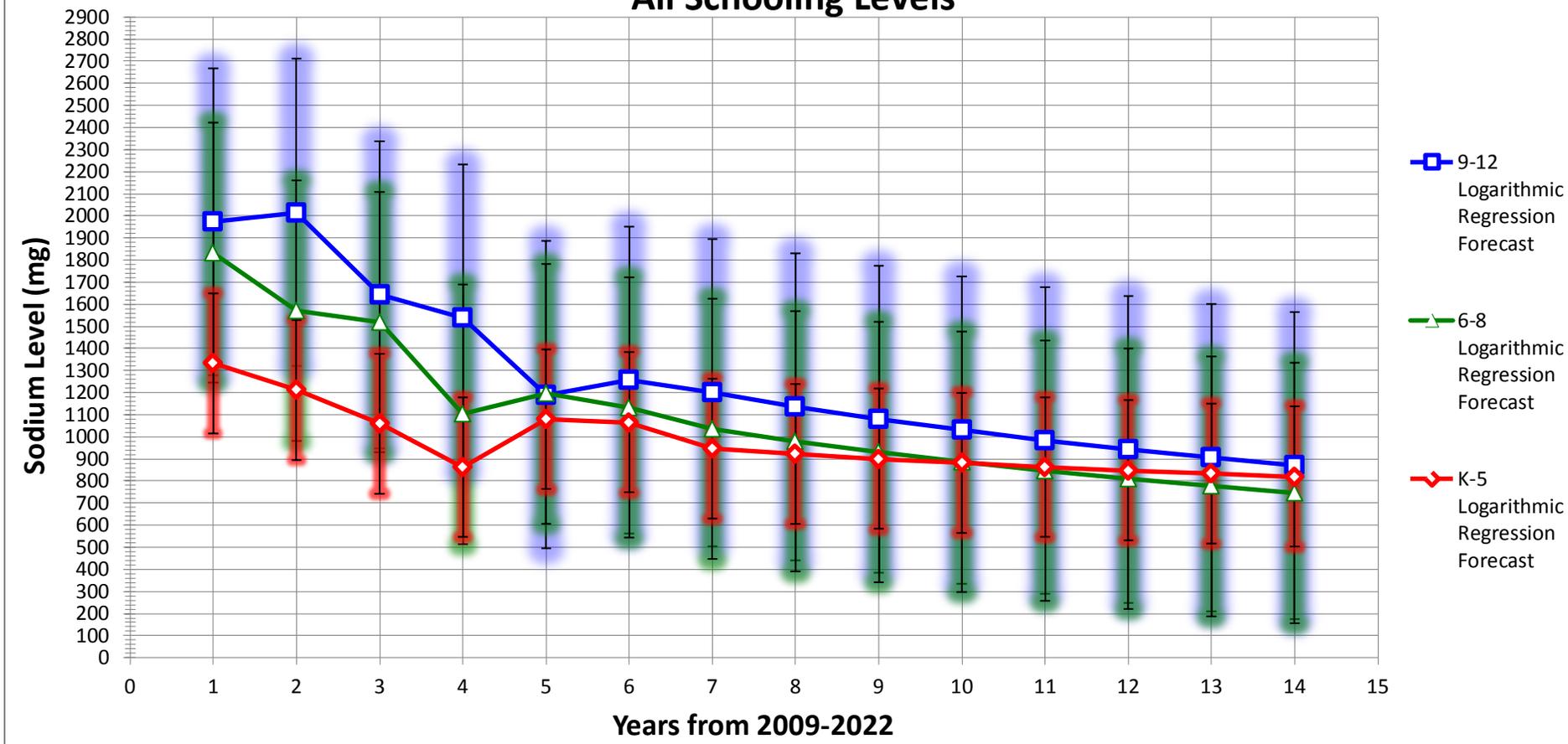


Figure 12: All schooling levels logarithmic regression forecast with error bars inside  $2\sigma$ .

## Discussion

This study illustrates that at the rate of sodium levels have been reduced in the last six years for the Cobb County National School Lunch Program, it would be possible for all levels of schooling to reach the USDA sodium level targets set for the 2022-2023 school year.

These findings are subject to significant deviation. The rate at which the initial drop sodium levels had occurred must be considered. It can be seen, especially in the data concerning middle school, 6-8 (figure 4) and high school, 9-12 (figure 9) level of schooling, that there is a significant drop in the sodium levels within the first two to three years. It is followed by it leveling off in the following years after. This is one of main reasons why the logarithmic regression seemed to be the best fit for the 6-8 data. As mentioned before, the exponential regression best fit the 9-12 data (figure 7) adding to the idea that the initial drop in sodium levels was quite significant. This is less likely to occur as it becomes more difficult to reduce sodium levels further in the next few years as was voiced by many commentators toward the USDA in their final proposal [14].

Many factors need to be considered when looking at the data, some of which can significantly limit the ability of a local county school nutrition program from reaching the required target level set by the USDA. One major concern, which was voiced by many including the USDA, is the increase in cost to the SNP in order

to reach the suggested sodium target. This worries many, since the USDA predicted cost for both food and labor for all aspects of the final proposed rule would increase by \$3.2 billion dollars from 2012 to 2016 [14]. What is interesting in this estimate is that the USDA does not consider the cost of decreasing sodium levels. They assume that the first set of targets can be met by merely reformulating recipes to meet the initial requirement to serve more vegetables, fruit, and increase whole grains [14, 78]. In interviewing the Cobb County School Nutrition Program Associate Director of Nutrition and Menus, Susan Marini, she reiterated that Cobb County was able to achieve their first target goals for all levels of schooling by reformulating recipes and putting in the time and care to make more appropriate selections in food that could help reducing sodium levels in their meals offered, but further reduction would be difficult [79]. Research has been done investigating not only the cost of reducing sodium levels but also the complexity of doing so in the competitive market.

Review of the literature reveals that costs do not merely focus on sodium and its impact producing healthier, lower sodium school meals. Woodward-Lopez et al. looked at the development of meals for school lunches with a method called scratch-cooking in comparison to utilizing processed foods [80]. Lopez found that in 10 school districts in California, the more a specific entree was cooked from scratch, that is from less preserved, already made ingredients, the higher the labor cost, but this cost leveled out with lower food cost in comparison to already made foods. Nonetheless, there was a higher cost associated with cooking “from scratch”, but it

was not significant. Another study performed by Treviño et al. showed no significance in cost of providing a healthier meal to middle school children when comparing 42 middle school (21 intervention and 21 control) in five states [81]. It must be mentioned that Lopez did not take in consideration absolute cost of preparing food such as adding more kitchen equipment, increasing training for staff, increase number staff, and other limitations that can be associated with wages and benefits for employees in each state. Whereas Treviño took into account financial reports from several different sources that may have reported on items, in which Lopez wasn't able to take in consideration [81]. As for nutrition, Lopez et al. elaborated that there was an insignificant drop in many on the standards including sodium [80]. This could be due to not changing the menu options (still making pizza, chicken nuggets, hot dogs, Mexican style burritos, nachos, quesadillas, etc.) offered but merely changing how the food was prepared. Yet, a study that looked at chicken bought from raw and prepared from scratch instead of utilizing precooked and processed poultry in Saint Paul Public Schools and Chicago Public Schools prove to be significantly lower in sodium [82]. The Saint Paul Public Schools were able to produce a chicken leg with 88mg of sodium and Chicago Public Schools produce a seasoned chicken leg with 300mg of sodium. This is in comparison to already cooked and preserved option, which equated to 620mg of sodium. When it came to value, utilizing fresh chicken proved to be more cost effective, roughly being half the cost in comparison to buying processed option for the smaller school district of Saint Paul Public Schools. For Chicago Public Schools, an initial investment needed to be incorporated for training and advertising. These nutrition-related costs did

not impact the elementary school budget, but did add a slight increase in the high school budget, mostly due to an extra chicken drum stick that need to be served, but was just slightly higher in cost than the least expensive processed chicken item that could be purchased [82].

Of additional concern is the ability of food distributors to be able and reach sodium levels requirement for food sold in the school lunch program. Gase et al was able to interview 18 organization based in the county of Los Angles, whom provide food to many public and private non-county entities [83]. In interviewing these organizations, Gase found that decreasing sodium levels would seem difficult for most of the public organizations. Yet, many of the private organization, whom require to stay in a competitive market place, report a minimal cost increase, citing their ability to negotiate lower prices on large volume purchase and utilized scratch-cooking methods so as to control sodium levels, along with other nutrition, in their food items produced [83].

Although, the cost of providing a healthier school lunches is a major factor on trying the reach the nutrition standards set by the USDA. Student participation in the school lunch program becomes even more worrying, especially when there is a restriction on salt, putting the taste of the meal in jeopardy [14, 84]. Taste is of serious concern but it should not change participation in the school lunch program. Beauchamp and Engelman found that a decrease in salty food is followed with a decrease in taste for salty foods, and that this reaction to a decrease in salt

preference is not associated on the physiological bases of needing salt in the human body [85, 86]. This is supported with an experimental study depicting a decrease in salt intake by 30-50% over period of time, about 1-2 months, decreasing the level of salt preferred in food [87]. Thus, most individuals will develop and increase acceptance for lower sodium food. It must be understood that the reason for salt being so prevalent in popular products distributed is that companies believe that it is a consumer preference and that would be hard to change [56]. Preference may be concerning, but decreasing salt in these products and contribute to a lower intake in salt can be done with consumer practically being unaware. For example, if sodium levels were reduced in these products quite slowly, perhaps over several month or even years, then salt intake would generally fall, while the palate's sensitivity to salt goes up, possibly leading to less desire for salt.

Participation in the School lunch program may be concerning, but the likelihood of student participating in the school lunch program and throwing away most of the food they purchased is a topic in which there is significant research on. The belief is that as food offered at school becomes healthier and in turn has less salt, there would be an increase in food waste due to children not eating their complete meal leading to less nutrition being consumed. Cohen et al. showed in a study that there was a substantial amount of food waste when looking at normally served school lunch in Boston between the 2007-2009 school years. However, when compared to school in which initiatives were taking to provide healthy foods to children less waste was observed [88]. Overall, students responded well to new

lunch standards [89, 90]. According to Schwartz et al., consumption is increasing for fruits, vegetables, and entrees from 2012 to 2014, but consumption in 2013 was quite low, initially when many of the new standards were implemented [90]. Yet, this trend does show a growing acceptance for healthier food and decreasing sodium levels could follow the similar development of approval. It seems logical that sodium can follow the same path. Children could initially be hesitant to try and possibly even buy the new meals that have lower sodium levels. Nevertheless, children were able to get used to having more fruits and vegetables, eventually learning to embrace the new foods offered according to Schwartz. What it really comes down to is giving a child or adolescent the time to get accustomed to these levels to develop the proper pallet. This was proven in many countries that have tried to reduce sodium consumption nationwide through education and intervention.

In the late 1950's, Japan had the highest death rate occurring from stroke compared to any other nations at the time, and these stroke case correlated with the high consumption of sodium [56]. Thus, the country found it necessary to initiate a campaign to reduce salt intake. A decade into the campaign, on average the country was able to reduce sodium intake from 13.5 g/day to 12.1g/day, were as in north Japan consumption decrease quite significantly from 18 g/day to 14 g/day. This reduction benefitted both adult and children in lowering their blood pressure and decreasing stroke mortality by 80% [91]. Finland in the late 1970's dwelled deeper into their intervention [56, 92]. Noticing that they were having issue with large salt

intakes reaching 12g/day, they incorporated salt reduction through a campaign. The government also became more involved in the food distributed and sold across the nation, controlling the food industry along with implementing salt label legislation. They were able to produce results, getting sodium intake down to less than 9g/day over 20 years [92]. The United Kingdom became aware of the country consuming too much salt in the mid 1990's and was able to implement policy and strategy to help reduce salt intake from 9.5 g/day to a goal of 6g/day [93]. The strategy was indeed complex and specifically tailored for the United Kingdom, but the result showed a reduction to 8.1g/day by 2011. More importantly, the government was able to implement a reduction of sodium in as many as 144 products, out of the goal of 204 products. The UK is staying on top of their standards and is planning to reduce sodium standards once more in 2017 so as to reach sodium target of 6 g/day [94]. Further evidence on the effect of what health education can do to help reduce salt intake in Chinese children was determined by He et al., where He took 279 children in primary school (around 10 years of age) and educated them on the harmful effect of a high salt intake. They would then relay the message of reducing sodium intake to their families, which included 553 adults to the study. Results produced for the intervention group showed a 1.9g/day decrease from the baseline of 6.8g/day in comparison to the control group whom had an increase in sodium intake from baseline. The increase in the control group may be due to seasonal changes (the northern Chinese usually have an increase in salt intake in the winter due to the consumption of more pickles rather than fresh vegetables) as the baseline readings were taken in the summer and final readings were taken in the winter.

Adult family members had a 2.9g/day decrease from the baseline 12.6g/day for the intervention group [95]. He et al further indicated a reduction in blood pressure was significant for adults but not for children in this study.

It seems possible to reach a voluntary reduction in sodium intake thus, it would be safe to assume that the young population can just as well adapt to the sodium level changes that are being implemented in the NSLP. What is concerning still to the school nutrition programs across the U.S. is not the first or second targets that have been set by the USDA for the NSLP, but the 3<sup>rd</sup> targets, 640 to 740mg of sodium per meal that seem really difficult with in the time constraints provided according to the School Nutrition Association [96]. This is emphasized in figures 12, were although these values are in range of the standard deviation, as mentioned before the standard deviation might be considered slightly exaggerated due the significant drop displayed in 6-8 and 9-12 level of schooling. Figure 3 shows that reaching the levels of 640mg target set for K-5 level of schooling are on the lower end of the standard deviation. The reason that I mention this data separately is due to there not being such a significant drop in sodium levels as compared with the other two levels of schooling, possibly relating to a more accurate depiction of reaching said targets. In the interview with Susan Marini, Cobb County School Nutrition Program Associate Director of Nutrition and Menus, she reiterated this concern and went on the to further say that it would be difficult to reach additional USDA sodium targets while continuing to maintain dairy and protein targets [79]. These concerns were heard from many SNP's across the country and with the over

mounting concern of being able to reach set USDA target Congress has voted on implementing only the first target set by the USDA as of late December 2014 [97]. They further stated the second and third target might not need to be determined necessary until significant scientific evidence establishes that a reduction in sodium consumption for children and adolescents is warranted and the Secretary of Agriculture has certified that the USDA has reviewed the literature. Yet, the review above mentions that the benefit of reducing sodium in child's diet can be of some significance. Along with the future benefits of decreasing the possibility of developing certain types of disease that can lead to CVD, lowering the contribution to childhood obesity, and possibly help in decreasing aggravation to asthma there is a financial benefit to the cost of healthcare, which could be concerning due to the recent implementation of the Affordable Care Act.

According to Heidenreich et al., the cost of CVD will increase from \$273 billion in 2010 to \$818 billion by 2030 [98] putting a significant strain on the health care system. A 9.5% reduction in sodium intake could perhaps lead to one million fewer cardiac events saving over \$32 billion dollars a year according to the American Heart Association (AHA) [99]. If sodium consumption were decreased at a rate of 4% per year for 10 years, it would equate to a 280,000 to 510,000 decline in deaths [4]. It could be related that the financial strain incurred in the future, due to not taking the initial step in helping reduce sodium intake through a child's lunch, could very well offset the cost that need to be contributed to the NSLP to provide lower sodium meals. Congress does have understanding that contributing more

money to the NSLP and NBLP are need to provide healthier food and did so for the 2015 fiscal year by increasing the disbursement to the NSLP by 13.4% for this year in comparison to last year, amounting \$1.419 billion dollars increase [97]. Thus, an increase in funding to decrease sodium levels will not only possibly decrease the budgetary impact to health care in the future, but will also help in decreasing the incidence of high sodium intake-related disease and death.

## **Limitations**

One of the major limitations to this research was that it was restricted to only one county SNP (Cobb County). Taking into account other counties would have been beneficial to the data to understand the nature of sodium levels in the NSLP on a more regional level. Appropriately, the initial design of the study was to include other counties in the greater Atlanta area, these included Gwinnet, DeKalb, and Fulton Counties. Overwhelming difficulties have proven substantial in trying to attain data from the other three counties, mostly associated with lack of having data for all the years that were requested.

Second limitation concerns how the data was collected and what type of data was collected. The data was provided by the county school nutrition program and as such is subject to criticism on how collection of said data was performed. The precision of data could have possibly been better controlled if raw data was available for analysis. As well, knowing the type of meals that were included in the

data could have aided in having a better understanding of the shift to lower sodium levels during the initial integration of the new nutrition standards.

The third limitation is the period in which the data was collected. Data attained for more than 6 years could have supported in achieving a better standard deviation for future prediction. Thus, adding to a better accuracy and aiding in developing a better forecast for sodium levels in the next 8 years.

The fourth limitation is the data is limited schoolchildren that eat lunch in school and does not take into account lunches that are brought from home. It is considered that of the children that attend school, 40% bring lunch to school with them [100]. For Pre-K and Kindergarten students, Farris et al., determined that students whom brought a lunch from home were more like to have less sodium levels, but less nutritional quality, in their bag lunch meal compared to meals offered by the NSLP of the local school [101]. Thus, the data presented in study is not congruent with the sodium levels ingested for all students in school population.

The fifth limitation incorporated the information collected for the literature review section, in which this information was subject to publication basis. This could result in fewer article that relay the idea that excess sodium intake in children and adolescents can have no ill health effects on child or adolescents health, making the review more one sided.

## **Future research and studies**

Future research should incorporate more county SNP's for analysis to get a better interpretation of sodium levels in the greater Atlanta area. To help attain a better and more precise depiction of the effect of sodium in the NSLP, the raw data should be obtained from County SNP's to not only determine sodium level average, but also see which food items contribute the most sodium to meals served, and see the different trends that can be predicted when analyzing the raw data. This would be valuable in providing more detailed information that could not be depicted by merely attaining sodium averages per week, as was done with this project. As well, to better determine trends and further estimate the progress that the NSLP is making in reducing sodium levels in meals offered, it would be beneficial to get data from earlier years of the program. Ideally, in the analysis of the NSLP, it would be of an added benefit to perform a similar study of the NSBP, to interpret further the trends following the reduction of sodium in the breakfast program.

## Conclusion

It is recognized that there are significant negative effects that sodium can have on adults and it can be seen in the illustrated review the effect of excess sodium intake could possibly lead to unfavorable health outcome in children and adolescents. Understanding this, the USDA put in place policy that can initiate a decrease of sodium levels in the National School Lunch Program along with the National School Breakfast Program, making it more likely that American children and adolescents will decrease their sodium consumption in their daily diet. In the first year of implementing the USDA sodium target the Cobb County SNP was able to decrease sodium levels and achieve the first target. In accordance with the trends at which they were able to reach the first target, it seems likely they will most definitely manage to reach the second and third targets as set by the USDA in their final proposal. Yet, according to Congress, the evidence is not substantial enough to warrant a further reduction of sodium levels in both the NSLP and NSBP [97]. This decreases the rate of attaining the sodium goals need to help achieve daily recommend sodium intake.

It is disappointing to see this action take place in Congress, even when there are numerous studies, reviews, and meta-analysis that concluded that a reduction in sodium intake for a child would most likely be beneficial for their current and future health. It is well-advised by many organizations such as the American Heart Association and Centers for Disease Control and Prevention that children and

adolescents would find it beneficial to decrease the sodium intake in their daily diets [99, 102], even more so in obese children [102]. Further support for such action is voiced internationally from the WHO [1, 22].

Current trends in Cobb County NSLP make it seem possible to reach the said targets by the USDA, but the issue may result in the dramatic reduction in reaching third targets set by the USDA, which will be difficult to do in the seven to eight year time constraints set. That brings into question the ambitious nature of the targets. These targets could be considered difficult, but they are realistic nonetheless. Yet if not so, it would seem more necessary to reevaluate the targets set and change them to, what is determined by the USDA, be more of an approximate target that can be reached then to say there isn't significant evidence to prove that reducing sodium in children and adolescents would be beneficial.

Indeed, the law needs to be revisited. Possibly setting target that would seem more likely to be reached or increasing the time it takes to reach said targets so as to let food producers, distributors, and school kitchens adjust (all of whom complain about the ability to reach said targets [14]) could be more justified.

The importance of revisiting this policy is not merely to help decrease sodium intake in children currently, but it becomes more important that implementing this policy will as well help educate students of the role sodium plays in their diet. Especially helping in realizing that future consumption of high amount

of sodium is known to be deleterious, not so much to their young bodies, but to their future selves. This education starts in the school cafeteria.

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