Bringing Awareness to Potential Social Determinants and Recycling Rates within the Berkeley Unified School District

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Abstract The California Integrated Waste Management Act of 1989 lead to the development of the California Integrated Waste Management Board (CIWMB), which state mandated the cities and counties of California to meet a 50% reduction quota for their solid waste diverted to landfills. Measure D lead to the development of the Source Reduction and Recycling Board which set a goal of achieving 75% solid waste diverted from landfills for the Alameda County. Schools are a natural partner in the landfill diversion process. By weighing and recording weekly recyclable material and solid waste, this paper seeks to determine if the location of a public school, its population demographics and the schools Academic Performance Index (API) testing scores affect recycling rates among elementary schools in the Berkeley Unified School District. Defying my hypothesses, Rosa Parks had the highest diversion rate despite location, high proportion of minorities and low-income students and low API score. Rosa Parks demonstrates the importance of making recycling a priority in schools.

Introduction

The California Integrated Waste Management Act of 1989 (Assembly Bill 939) was signed into law by the governor of California, which lead to the development of the California Integrated Waste Management Board (CIWMB). This organization oversees each county's waste diversion plan; this encompasses source reduction, recycling and composting and the proper disposal of solid wastes. This act mandated the CIWMB to ensure that each city and county met certain reduction quotas of their solid waste beginning in 1990; 25% by 1995 and 50% by 2000 and every year thereafter (Orange County Grand Jury 2007, elect. comm.). Those who do not meet the goals set forth by AB 939 are fined up to $10,000.

In 1990, Alameda County voters passed Measure D. This measure created the Source Reduction and Recycling Board (SRRB) and set a goal of achieving a 75% solid waste accumulation diversion from landfills by 2010 in Alameda County (Alameda County SRRB 2003, elect. comm.). Schools are a natural partner in this diversion process.

Waste reduction is essential for school districts since they represent a significant loss of natural resources. Schools districts in California dispose of approximately 763,817 tons per year (CIWMB 2007, elect. comm.). In Alameda County, schools contribute an annual 4% or approximately 60,000 tons of waste deposited in landfills (Alameda County Waste Management Authority & Alameda County Source Reduction and Recycling Board 2008, elect. comm.). Of the 102,743 residents of Berkeley (Census 2000, elect. comm.), 10,189 are students and teachers in the Berkeley Unified School District (BUSD) (CIWMB 2007, elect. comm.). This 9.9 % of the population contributes an estimated 1,152.8 tons of waste per student per year (CIWMB 2007, elect. comm.), equating on average to $26 per student for waste at an annual management cost of $225,661 to the district (Brown 2004, elect. comm.). The CIWMB concentrates heavily on schools as they generate a significant amount of waste.

Green procurement – the implementation of waste reduction initiatives – was first initiated in the BUSD in 1995. Sometime during 2000-2002, the BUSD obtained recycling bins through a partnership with the Berkeley Solid Waste Management Office. Tania Levy works for the Berkeley Solid Waste Division in the Public Works Department and has commented that initially the recycling program for the BUSD was very chaotic and ineffective until Marcy Greenhut came into the picture as the BUSD Recycling Coordinator (Levy 2008, pers. comm.). Greenhut disclosed her frustration towards the BUSD and their nonexistent funding for recycling

programs for their schools. Even her position is paid through outside funding. Marcy Greenhut has recently finished a several year contract as the BUSD Recycling Coordinator. Levy expressed her concern that recycling programs might collapse in Greenhut's absence and hopes that custodians and teachers/administrative staff carry on (Levy 2008, pers. comm.). Much of the success of the recycling programs in the BUSD is because of the weekly 10-15 hours per week Greenhut has spent helping schools set up and maintain recycling programs, training custodians, troubleshooting, providing resources to interested staff and makes recommendations to the City for program staff (Greenhut 2007, pers. comm.).

The purpose of this paper is to determine if correlations exist between recycling rates among elementary schools in the BUSD and three social determinants: location, ethnic population and socioeconomic status and the schools Academic Performance Index (API) testing. Each of these has the potential to flood money and resources into a schools recycling program to improve and expand.

Elementary schools were chosen as the main focus in this study because the younger students make connections between the way humans live and the constant need to conserve our dwindling natural resources, the greater the possibility of developing meaningful lifelong lessons. According to Smith et. al. "environmental awareness education is the most effective on younger children who do not have well-established environmental habits" (Smith *et. al.* 1997, elect. comm.). This encourages students to evaluate their personal habits and consider their shared responsibilities in terms of the greater community to which we all belong, the world.

Schools have historically been funded by property taxes (EdSource 2007, elect. comm.). However, when Proposition 13 was passed in California in 1978, it drastically minimized local property taxes by 57% and thereby slashed the revenue allocated for schools (Institute of Governmental Studies 2005, elect. comm.). Property taxes are now capped at 1% of the full cash value of the property (California Tax Data 2002, elect. comm.) and for each dollar of property tax collected, 42% is distributed back to schools (Thomsen, elect. comm.). A PBS documentary, First to Worst, discusses the conditions of public schools in California and how they went from being the "national model" to "rank near the bottom" and how this is attributed to Proposition 13 (EdSource 2004, elect. comm.). Schools that are understaffed, over-crowded and in need repairs are not going to expend any funds into recycling efforts or environmental education versus concentrating on student achievement and in the process our environment is yet not a priority.

Recycling is not just important for saving non-renewable resources but it also saves room in our densely packed landfills.

Research suggests that impoverished and minority communities in America have not been taught or had reason to care about recycling or the state of the environment because they have other priorities (Coutenay 2000, elect. comm.). When recycling programs have been created in low-income and minority communities, the results have been very disappointing (Gold 1990, elect. comm.).

The Academic Performance Index (API) is used to measure the academic performance and growth of schools and is used to meet state and federal requirements. Scores are rated 1-10, 10 being the highest and are based on several tests and the score is calculated in comparison to 100 similar schools statewide. Schools that meet or exceed participation and growth criteria are eligible for monetary incentives and awards and are do not lose any funding for the following academic school year.

My hypotheses are: (1) schools in more affluent neighborhoods with high property taxes and property values will have higher recycling rates, (2) schools with a higher percentage of minorities and a higher percentage of low-income families will have the lowest recycling rates and (3) schools with higher API scores will have higher recycling rates.

Methods

There are eleven elementary schools in the BUSD. The BUSD is split up into three different zones: Northwest, Central and Southeast. The three elementary schools chosen for this study had the closest enrollment to better control for population size and were each in a different zone.

I met with the principals at Emerson, Oxford and Rosa Parks Elementary schools (Fig. 1) to discuss the details of the study, the process of data collection, the school's typical recycling regime, to talk to custodial staff about their involvement and to request permission to be on campus and access to recycling bins and refuse dumpsters. Each principal agreed to have the school participate in this study.

Recycling bins were weighed and recorded every week for 10 weeks commencing on February 11, 2008. Recycling service pickups (Table 1) were collected fairly early in the morning, so schools usually put out recycling bins the evening before. This is also when I visited the schools to better ensure that recycling weights were more accurate. The Oxford

Elementary school principal disclosed that many neighbors like to mix their recycling with the schools. Recycling bins were weighed on a portable digital scale with the weight of each recycling bin tared. During the first week, I randomly selected three garbage bags from the refuse dumpster to average the approximate weight of each school's garbage bag. An Average bag for Emerson Elementary was 20.6 pounds, 23.9 pounds for Oxford Elementary and 27.3 pounds for Rosa Parks Elementary. Thereon, an estimate count of garbage bags in the refuse dumpster was recorded and multiplied by the average weight of that school's garbage bag.
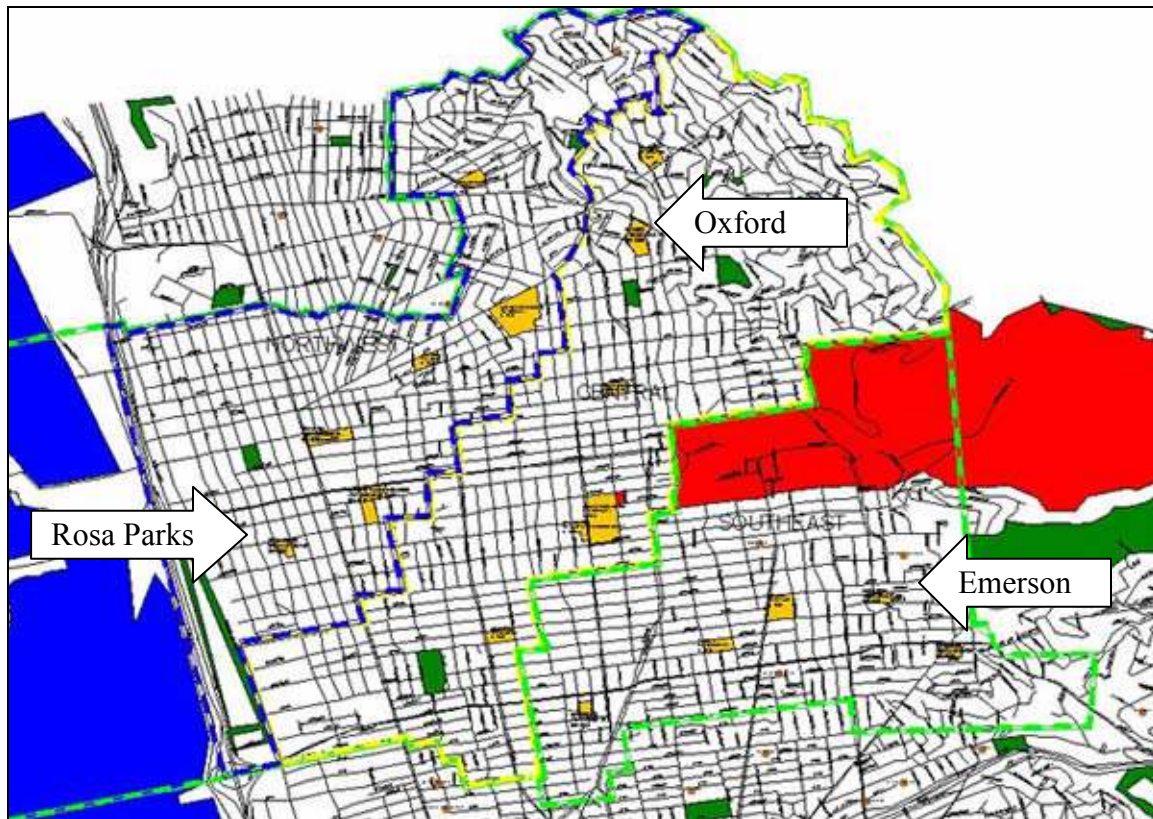

Figure 1: The three district zones adopted by the BUSD Board of Education on July 1994. Northwest (Blue) Zone: Rosa Parks, Central (Yellow) Zone: Oxford and Southeast (Green) Zone: Emerson.
Source. -http://www.berkeley.net/index.php?page=map-assignment-zones

Table 1: Recycling and Refuse Service Pickup Schedules

School	Mixed Paper	FoodScraps & YardWaste	Glass Bottles, Plastic Bottles (Type 1: PETE, Type 2: HDPE), Cans & Foil	Refuse Dumpsters
Emerson	Tu	M	M	M, Th
Oxford	M	M	M	M, Th
Rosa Parks	Th	F	F	M, Th

I also took a tour of the schools to consider the layout of recycling bins. At Emerson Elementary school mixed paper recycling bins were located in every classroom and office. Mixed paper recycling bins were also located near the front office hallway and located on the veranda connecting the administrative building to the classrooms. FoodScraps & YardWaste[1] bins were located in the cafetorium[2] and in the kitchens. The glass, plastic, cans & foil recycling bin was located right outside of the kitchen. At Oxford Elementary school mixed paper recycling bins were located in all classrooms and offices. FoodScraps & YardWaste recycling bins were located in the cafetorium and in the kitchen along with the glass, plastic, cans & foil recycling bin. At Rosa Parks Elementary school mixed paper is located in every classroom and office. Mixed paper and glass, plastic, cans & foil recycling bins were also located right outside of each cluster of classrooms. FoodScraps & YardWaste recycling bins were located on the cafetorium and kitchens.

To address my first hypothesis, I obtained information on property taxes online City-Data.com (Table 2). I looked up each schools zip code detailed profile to find the "real estate property taxes paid for housing units in 2000." Due to the potential of inaccuracy and timeliness of information on this site, I also considered using property values. Property values might be more meaning since property taxes can vary drastically between houses in the same neighborhood depending on when the property was purchased (Reinicke 2008, pers. comm.). "Approximate median home values" were obtained from schoolsk-12.com and were also done by zip code (Table 2).

To address my second and third hypothesis I have obtained information about ethnic and socioeconomic breakdowns and API test scores from the Ed-Data Partnership website[3] (Table 3). For my analyses on ethnic and socioeconomic status I used the Ethnic Diversity Index which measures how much variety/diversity a school has among the seven ethnic categories of students (American Indian, Asian, Pacific Islander, Filipino, Hispanic, African American and White). Numbers range from 0-100, where numbers close to 100 signify a fairly even distribution, while numbers closer to 0 signify a school with students predominantly from a single ethnic group (Ed-Data Partnership 2008, elect. comm.). I also used Socioeconomically Disadvantaged which are

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[1] FoodScraps & YardWaste as labeled on the green recycling bins to combine compost and plant debris by the City of Berkeley

[2] cafetorium is a room, usually in a school, utilized as both a cafeteria and an auditorium

[3] Ed-Data Partnership, Fiscal, Demographic, and Performance Data on California's K-12 Schools: http://www.ed-data.k12.ca.us/welcome.asp

students whose parents do not have a high school diploma or participate in the schools free-reduced price lunch program because of low family income (Ed-Data Partnership 2008, elect. comm.).

I performed non-parametric (Spearman) correlations since my variables (property taxes, property values, ethnic diversity index, socioeconomically disadvantaged and API scores) were not normally distributed. Because my sample size is so small, I had to run the correlation test with each schools total weekly recycling amounts against my variables.

Results

At the conclusion of ten weeks (Raw Data in Appendix), Emerson Elementary recycled the most mixed paper, while Oxford Elementary recycled the least mixed paper. Oxford Elementary recycled the most FoodScraps & YardWaste, while Rosa Parks Elementary recycled the least. Rosa Parks Elementary recycled the most glass, plastic, cans & foil, while Emerson Elementary recycled the least (Table 4). While Oxford recycled the most, they also generated the most waste and therefore their overall diversion rate was the smallest. Rosa Parks recycled the most overall and created the least amount of waste and therefore their diversion rate was the highest (Table 5).

Positive, yet weak correlations resulted with recycling rates and property taxes and property values. Again, a positive, yet insignificant correlation was found between recycling rates and API scores. However, negative correlations were found among recycling rates and Ethnic Diversity Index, Socioeconomically Disadvantaged (Table 6).

Table 2: Property Taxes and Property Values by Zip Code

School (zip code)	Real Estate Property Taxes Paid for Housing Units in 2000	Approximate Median Home Value
Emerson (94705)	$3, 186	$1,224,800
Oxford (94704)	$4,114	$932,800
Rosa Parks (94710)	$2,123	$489,400

Table 3: Academic Performance Index, Ethnic and Socioeconomic Breakdown

	Emerson	**Oxford**	**Rosa Parks**
Enrollment	290	280	370
API Score	7	8	5
Ethnicity			
American Indian	0.0 %	0.4 %	0.8 %
Asian	7.2 %	5.0 %	4.1 %
Pacific Islander	0.0 %	0.4 %	0.0 %
Filipino	0.7 %	0.7 %	0.3 %
Hispanic	15.5 %	10.7 %	32.4 %
African American	30.7 %	26.8 %	22.7 %
White	26.9 %	35.4 %	26.8 %
Multiple/No Response	19.0 %	20.7 %	13.0 %
Ethnic Diversity Index	57	53	57
Family Factors			
Low-Income Indicator	52 %	40 %	58 %
Parents with some College	81 %	85 %	61 %
Parents with College Degree	55 %	68 %	36 %
Socioeconomically Disadvantaged	92 Students	75 Students	127 Students

Source.- "Enrollment, Ethnicity and Ethnic Diversity Index" Based the California Department of Education, Education Demographics Office (CBEDS) May 2007. "API Score and Socioeconomically Disadvantaged" Based on the California Department of Education, Policy and Evalution Division (2007). "Family Factors" Based on the School Accountability Report Card, 2006-07 (SARC) which is "an annual report to the community about teaching, learning, test results, resources, and measures of progress in our schools", data is the most current as of March 2007.

Table 4: Breakdown of Recyclable Material

School	Total Mixed Paper (Pounds)	Total FoodScraps & YardWaste (Pounds)	Total Glass, Plastic, Cans & Foil (Pounds)
Emerson	2537.1	2444.4	178.8
Oxford	1874.9	2574.81	718.6
Rosa Parks	2301.1	905.0	811.1

Table 5: Waste diversion rates for week period

School	Total Waste Diverted (Pounds)	Total Waste Generated (Pounds)	Diversion Rate (%)	Waste per Week per Child (Pounds)
Emerson	5160.3	3831.6	57.39	31.00
Oxford	5168.31	5975	46.38	39.80
Rosa Parks	4017.2	2668.1	60.09	18.07

Table 6: Correlation Results of Recycling Rates against Several Variables

	r value
Property Taxes	0.16
Property Values	0.19
Ethnic Diversity Index	-0.29
Socioeconomic Disadvantage	-0.32
API Scores	0.32

Discusssion

Although property taxes and property values have positive correlations (Table 6), they refute my first hypothesis that schools is more affluent neighborhoods (i.e. with higher property taxes and property values) would have higher recycling rates. The correlations between the total amount of recycling collected per week and property taxes and values are very weak. Although, realistically, property taxes can have a severe impact on local schools. If a public school is in an affluent area, its local property taxes will be high, translating into more funding for the school. If a public school is in a poorly shaped neighborhood where people do not want to live, property taxes and values will be low and so will the contributions received from local property taxes. Perhaps if more elementary schools within each district zone were also included in the study, there would be a higher correlation between these variables. Another consideration is that while property taxes and values do affect school funding, perhaps school funding is not affected significantly by school funding. For example, Rosa Parks is embedded within a more impoverished and minority stricken community than Emerson and Oxford and so feels the value of every dollar spent more hesitantly.

Rosa Parks Elementary School has the highest Ethnic Diversity Index and the highest amount of Socioeconomically Disadvantaged students, yet they have the highest diversion rate, refuting my second hypothesis. Negative correlations were found between recycling rates and

high numbers of minorities and low-income families. This tells us that these variables work opposite each other; as the amount of minority and low-income families decrease, the diversion rate will increase. However, this may not actually hold true since Pat Saddler, the principal at Rosa Parks, disclosed that the students are not avidly involved in the schools recycling regime. Whereas students at Emerson and Oxford, empty their classroom recycling bins to a central location and are encouraged to sort their lunch in appropriate recycling bins. Thus, Rosa Parks might have a higher diversion rate because recycling duties fall heavily on staff versus the students. Rosa Parks also has something that the other schools do not have, onsite recycling coordinators. They make sure to train and educate staff members about recycling and its structure on campus so staff can then educate their students about the importance of recycling.

Although the correlation between recycling rates and API scores were positive and weak, it did have the highest correlation of the variables tested, as expected. According to Randall Parker, students with higher scores behave better and due so because they are able to "stimulate and understand the effects that one's behavior has…and see how one's actions can harm one's won prospects" (Parker 2007, elect. comm.). However, the data does not support my hypothesis because Rosa Parks with the highest diversion rate also has the lowest API score of the schools taken under consideration.

There were other confounding factors that were noticed during this study besides the already mentioned above small sample size and student involvement. The existence of cooking/gardening classes at the school can greatly affect the amount of food scraps. Schools with 50% or more low-income students have cooking/gardening intervention programs, which greatly stress the importance of composting and use some of the schools compost in their schools garden. Both Rosa Parks and Emerson have cooking/gardening programs. Another potential confounding factor is that Oxford Elementary school has a dishwasher in their kitchen. Janet Levenson, the principal at Oxford, stated that they are one of the few school in the district with a dishwasher. She has been trying to encourage her staff to regularly use silverware and plastic reusable trays versus plastic silverware and paper plates/trays, but has been having some difficulty with her staff. Another factor occurred when interviewing custodial staff. Majority of the work falls upon them to maintain diversion projects unless a teacher or parent volunteers their time. This maintenance is not in there job description and therefore are not paid for the additional hours to fulfill recycling duties. Emerson, Oxford and Rosa Parks all have one

custodian.   Even with Rosa Parks having an additional 80-90 students than Emerson and Oxford, the reason why they have a higher recycling rate is because of the designated recycling coordinator that assists and supports not just the custodian but the recycling program. When all the weight of diversion projects fall on one person, the program falls short of its full potential; "everyone needs to contribute with full participation…then the custodian would feel much more respected and recycling programs would be more successful" (Rowan 2003, elect. comm.). One last factor to consider was the distinction between waste recycling and waste prevention. Just because a school does not recycle more than another, does not imply that they do not recycle or do not know how to effectively recycle, it might mean that a school strongly advocates for stopping waste at its core-to reduce waste generation to begin with and thus reduce the need for recycling. For example, one alternative view as to why Rosa Parks compost so little is because they teach their kids not to take more that they can eat at lunch.

My research findings have shown that there are correlations between recycling rates and API scores, property taxes and values. However these correlations are rather weak, but if a larger sample size was performed and the above confounding factors were addressed, perhaps future findings would demonstrate different results.

The ultimate goal of this study was to bring awareness to potential social determinants that can affect recycling rates within school districts. This study can shed light on what factors give more effective recycling rates that could ultimately save schools and school districts a significant amount of money.   The secretary of Berkeley's Solid Waste Management Commission stated that currently

> "schools are saving an estimated $80,000/year from recycling, because all the recycling is free, and the compost/food waste collection is 20% cheaper than equivalent refuse service. This is just the savings from recycling. When we started we made sure that schools were not buying more refuse service than they needed and suggested they reduce summer service. This "right-sizing" saved them an additional $20,000/year" (Levy 2008, pers. comm.).

These savings could potentially be used to educate and reeducate people on recycling programs and involve them in improving the environment, especially since the primary goals are to increase environmental knowledge and to instill and promote pro-environmental attitudes and behaviors (Smith et. al. 1997, elect. comm.). Through recycling we can make the most of the scarce natural resources we do have without completely depleting reserves.

Acknowledgements

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Appendix 1: Raw 10 Week Data

School	Week		Mixed Paper	FoodScraps & YardWaste	Glass Bottles, Plastic Bottles (1,2), Cans, and Foil	Waste Estimate (lbs)	Total Recyclable Material (lbs)
Emerson	1	11-Feb	277.4	325.3	19.1	453.2	
Emerson	2	18-Feb	384.1	90.4	31.1	453.2	
Emerson	3	25-Feb	270	161.2	6.1	247.2	
Emerson	4	3-Mar	242.7	295.8	18.1	473.8	
Emerson	5	10-Mar	216.9	325.4	14.6	576.8	
Emerson	6	17-Mar	282.7	314.7	19.6	432.6	
Emerson	7	24-Mar	183.2	298.3	19	432.6	
Emerson	8	*31-Mar*	292.8	245.3	21	144.2	
Emerson	9	7-Apr	249.3	310.1	17.9	226.6	
Emerson	10	14-Apr	138	77.9	12.3	391.4	
TOTAL			*2537.1*	*2444.4*	*178.8*	*3831.6*	*5160.3*
Oxford	1	11-Feb	85.3	136.5	49.3	693.1	
Oxford	2	18-Feb	155.9	171.5	48.7	693.1	
Oxford	3	25-Feb	310	377.3	69.5	717	
Oxford	4	3-Mar	250.3	477.21	77.2	764.8	
Oxford	5	10-Mar	230.6	444.2	79.6	740.9	
Oxford	6	17-Mar	112.1	439.5	85.4	764.8	
Oxford	7	24-Mar	394.9	101.3	145.1	669.2	
Oxford	8	*31-Mar*	0	0	0	239	
Oxford	9	7-Apr	152.7	172.9	90.9	334.6	
Oxford	10	14-Apr	183.1	254.4	72.9	358.5	
TOTAL			*1874.9*	*2574.81*	*718.6*	*5975*	*5168.31*
Rosa Parks	1	11-Feb	119.5	96.8	106.3	327.6	
Rosa Parks	2	18-Feb	289.7	138.4	45.8	191.1	
Rosa Parks	3	25-Feb	455.5	88.2	150.8	409.5	
Rosa Parks	4	3-Mar	225.8	87	51	327.6	
Rosa Parks	5	10-Mar	253.4	85.5	83.9	354.9	
Rosa Parks	6	17-Mar	271.8	92.8	72.7	327.6	
Rosa Parks	7	24-Mar	174.2	63.5	66.7	218.4	
Rosa Parks	8	*31-Mar*	0	0	0	0	
Rosa Parks	9	7-Apr	303.3	133.6	126.3	156.5	
Rosa Parks	10	14-Apr	207.9	119.2	107.6	354.9	
TOTAL			*2301.1*	*905*	*811.1*	*2668.1*	*4017.2*