

# A Category 1 Randomized, Single-Center, Comparative Study of Hand Hygiene Techniques in School Age Children



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## INTRODUCTION

Hand hygiene has been shown to reduce the transmission of infection. However, today's market presents the population with an overwhelming number of possible products, including antibacterial hand soap, regular hand soap, and alcohol-based hand sanitizer. Proper hand hygiene is especially important in children (ages 6-12) because they have a higher incidence rate of upper respiratory infections than the general population. The virus that causes upper respiratory infections is easily spread through hand-to-face transmission, which can be prevented through effective hand hygiene. However, everyone can benefit from knowing correct the best methods of hand hygiene.

Previous studies required participants to wash their hands for 30-60 seconds. In reality, most people wash their hands for an average of less than 15 seconds. This study measures microorganism count after the typical time spent washing hands of 15 seconds in order to reproduce a real-life situation.

Benefits to finding the most effective hand hygiene method may include decreased student and adult absenteeism, resulting in improved academic success and decreased employer costs. Hospitals may also benefit from the results; in one study, a facility was found to have saved approximately \$2,100 per individual infection avoided, even after the assumption of only a 25% improvement in hand hygiene. (Centers for Disease Control and Prevention, 2002).

## OBJECTIVE AND METHOD

- To find the most effective hand washing technique between antibacterial hand soap, non-antibacterial (regular) hand soap, and alcohol-based hand sanitizer
- Recruit children between the ages of six and twelve to voluntarily participate in the research study
  - Inclusion Criteria:
    - Participant attending a private school in Jackson County
    - Signed and dated parental or caregiver consent
    - Child's signed and verbal assent
  - Exclusion Criteria
    - Skin sensitivity, skin conditions (e.g., psoriasis, eczema) or allergy to any of the hand hygiene products
    - Any other factor that might place the child at an increased risk or preclude the child's full compliance with or completion of the study
- Perform the ANOVA test between all three hand washing techniques to determine if there is a difference among the three groups
- Perform the student *t*-test pre- and post-test to determine if there is a reduction in microorganism count in all 3 groups: Antibacterial soap; regular soap; and, hand sanitizer.

## MATERIALS AND PROCEDURES

### Materials:

- 1 Hygiena SystemSURE Plus ATP Luminometer
- 200 ATP Monitoring Device Swabs
- SoftSoap Crisp Clean Liquid Antibacterial Hand Soap
- SoftSoap Regular Liquid Hand Soap
- Purell Advanced Instant Hand Sanitizer
- Store-brand Paper Towels
- Dum Dum Pops

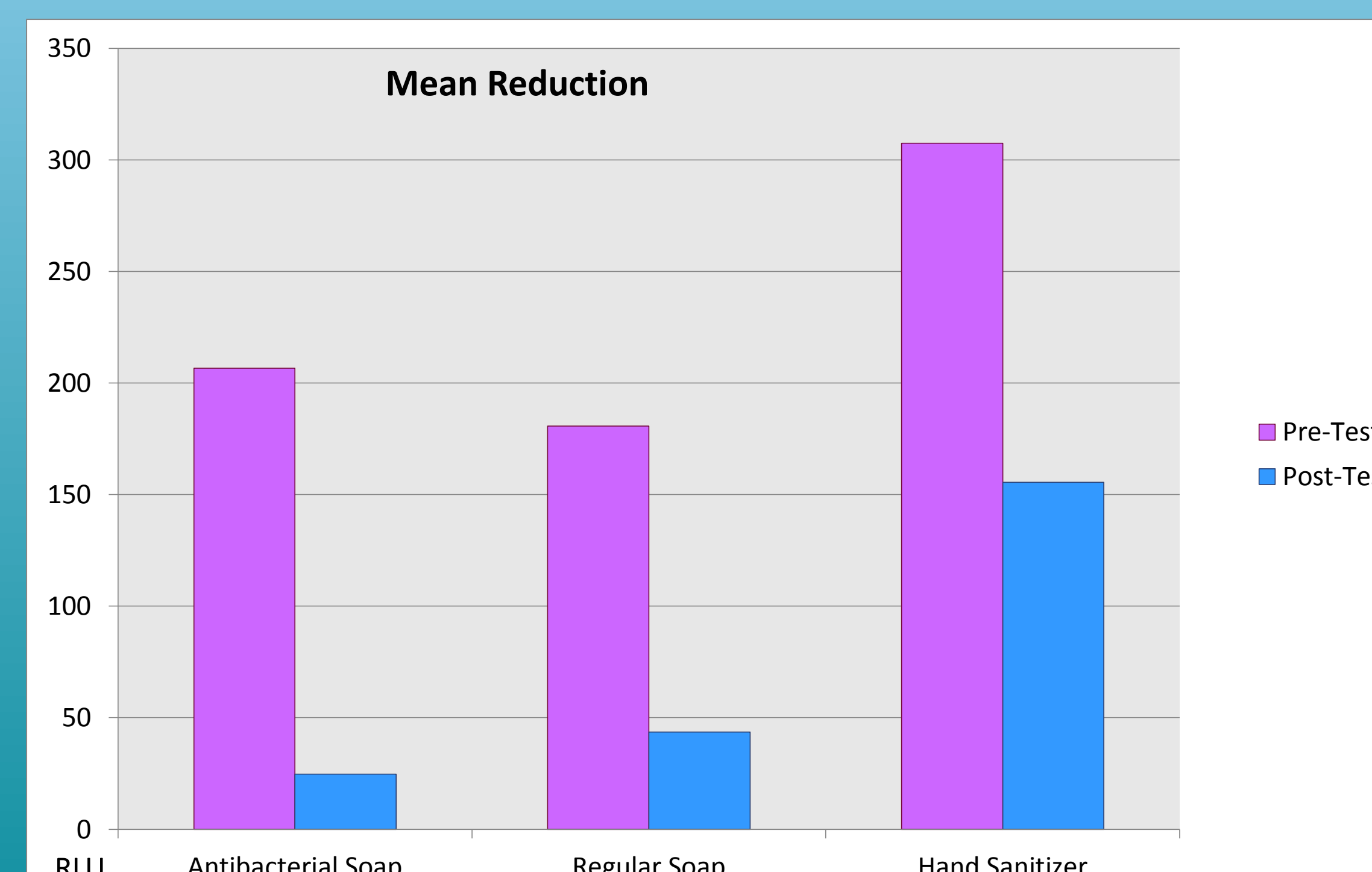
### Procedure:

1. Parental consent and child assent forms were made and distributed to the students of appropriate age with instructions to be turned in the following week on the day of the research study
2. Flyers were also distributed to teachers and parents with condensed information regarding the study
3. On the day of the study, the research leader met with the principal and teachers of the school before the study to discuss final details of the study, and to answer any last questions regarding the study
4. After collecting parental consent and child assent forms, participants were randomly assigned to one of the three hand washing techniques using systematic sampling
5. Each participant had their dominant hand swabbed with an ATP monitoring device swab between each of the fingers and the palm of the hand
6. The swab was then placed inside a Hygiena SystemSURE Plus ATP Luminometer for a pretest measurement of the microorganism count on the hand of the participant
7. Data was entered into an Excel Spreadsheet for pre-test organism count
8. The participant then went to the hand washing station for their randomly assigned hand washing technique
  - Each participant was instructed to rinse their hands with water (unless they used hand sanitizer)
  - The participant was then given one pump (1.5 mL) of the assigned hand washing product
  - Each participant rubbed their hands thoroughly with their hand washing product for 15 seconds
  - Each participant then rinsed off their hands and was given a paper towel to dry their hands (unless they used hand sanitizer)
  - Participants using hand sanitizer rubbed their hands together for 15 seconds and then dried with a paper towel.
9. After completion of the hand washing technique, the participant's same hand was again swabbed between each of the fingers and palm of the dominant hand
10. The post-test swab was placed inside the luminometer for a microorganism count
11. Data was entered into an Excel Spreadsheet for post-test organism count

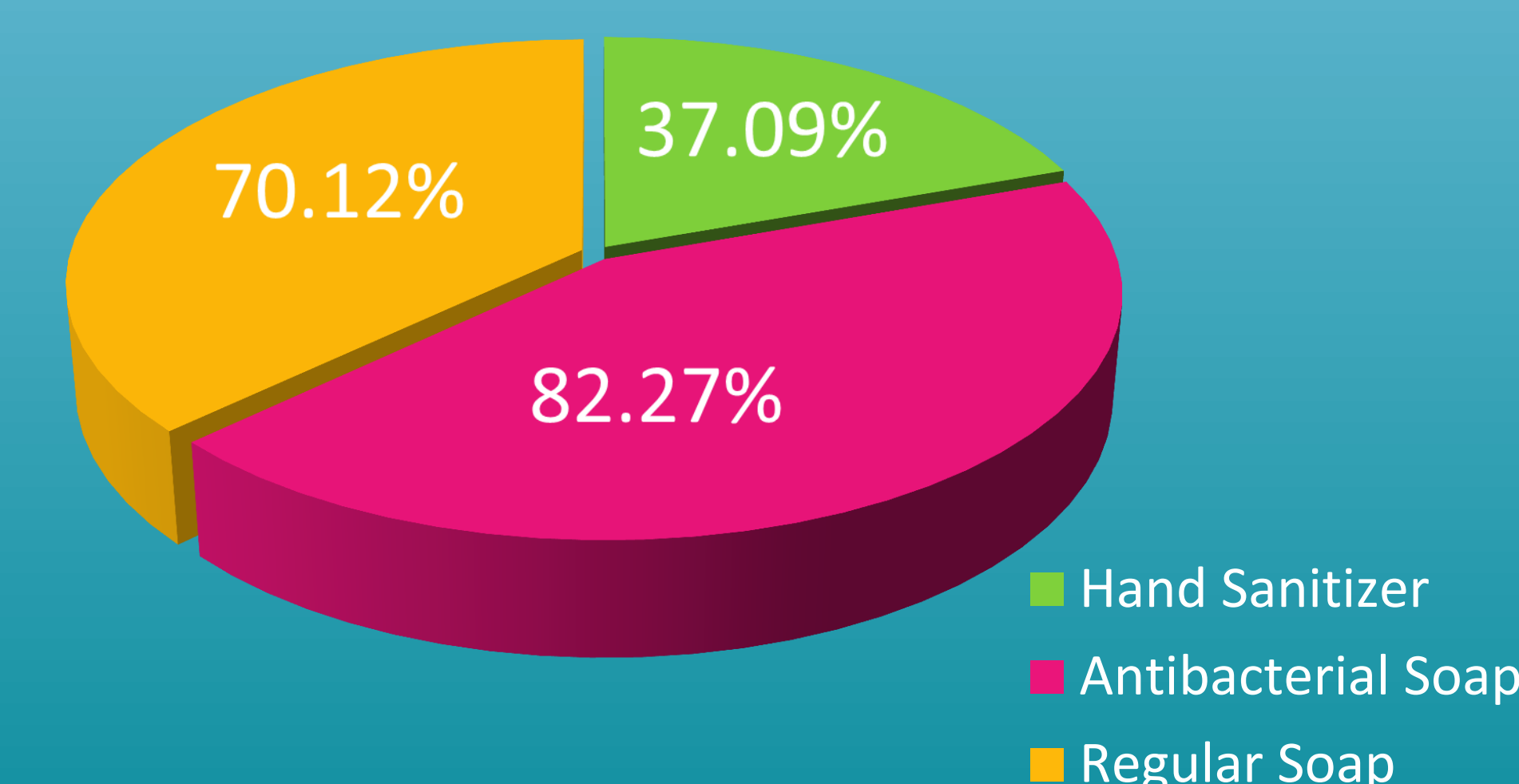


## RESULTS

- There was no difference between the pre-test groups after using the ANOVA test (showing that each group was randomly assigned)
- There was a significant difference among the post-test groups after using the ANOVA test
- There was a significant difference between each group's pre- and post-test using the student *t*-test
- There was no significant difference found between using antibacterial soap and regular soap in a 2-tailed test, but there was a significant difference found between using either antibacterial soap or regular soap and hand sanitizer



## Percent Reduction of Microorganisms



## STATISTICS

ANOVA: Single Factor				
POST_TEST SUMMARY				
Groups	Count	Sum	Average	Variance
Antibact. Post	32.00	790.00	24.69	736.16
Regular Post	33.00	1,437.00	43.55	2,825.57
Sanitizer Post	29.00	4,511.00	155.55	27,867.68

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	300,786.20	2.00	150,393.10	15.32	0.00	3.10
Within Groups	893,534.23	91.00	9,819.06			
Total	1,194,320.43	93.00				

t-Test: Two-Sample Assuming Unequal Variances			t-Test: Two-Sample Assuming Unequal Variances			t-Test: Two-Sample Assuming Unequal Variances		
ANTIBACTERIAL VS REGULAR HAND SOAP			ANTIBACTERIAL SOAP VS HAND SANITIZER			REGULAR SOAP VS HAND SANITIZER		
	Antibacterial	Regular		Antibacterial	Sanitizer		Regular	Sanitizer
Mean	25.03	44.88	Mean	25.03	145.86	Mean	44.88	145.86
Variance	756.77	2,856.50	Variance	756.77	26,073.31	Variance	2,856.50	26,073.31
Observations	31.00	32.00	Observations	31.00	28.00	Observations	32.00	28.00
Hypothesized Mean Difference	0.00		Hypothesized Mean Difference	0.00		Hypothesized Mean Difference	0.00	
df	47.00		df	28.00		df	32.00	
t Stat	-1.86		t Stat	-3.91		t Stat	-3.16	
P(T<=t) one-tail	0.03		P(T<=t) one-tail	0.00		P(T<=t) one-tail	0.00	
t Critical one-tail	1.68		t Critical one-tail	1.70		t Critical one-tail	1.69	
P(T<=t) two-tail	0.07		P(T<=t) two-tail	0.00		P(T<=t) two-tail	0.00	
t Critical two-tail	2.01		t Critical two-tail	2.05		t Critical two-tail	2.04	

## LIMITATIONS

- Twice when reading hand sanitizer post-test data and once when reading antibacterial soap post-test data, the luminometer appeared to malfunction by producing data that was more than the pretest. This data was considered an "outlier" and removed from the data results.
- These study findings cannot be generalized to students outside of the study population; however, it is reasonable to assume that all children would have similar pre- and post-test results regardless of location.

## CONCLUSIONS

All three forms of hand hygiene are effective at reducing the microorganism count from hands. There is a slight statistical significance between antibacterial hand soap and regular hand soap using a one-tailed test which disappears with a more stringent two-tailed test. There is a significant statistical difference between both antibacterial soap and regular soap when compared to hand sanitizer.

## REFERENCES

Centers for Disease Control and Prevention (2002). *Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices, Advisory Committee and the HICPA/SHEA/APIC/IDSA Hand Hygiene Task Force* (MMWR No. RR-16). Retrieved from CDC website: <http://www.cdc.gov/mmwr/PDF/rr/rr5116.pdf>

## ACKNOWLEDGMENTS

This study could not have been made possible without grants from both the IUPUC Office of Student Research and the Indiana University School of Nursing at IUPUC.

