



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
2019 PROJECT SUMMARY**

<b>Name(s)</b> <b>Zuriel Erikson Joven</b>	<b>Project Number</b> <b>S1212</b>
<b>Project Title</b> <b>Development and in Vitro Evaluation of Dextrose Transdermal Patches as a Low-Cost Alternative to Intravenous Delivery</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The purpose of this project was to evaluate the feasibility of transdermal patches as a cost-effective replacement for the intravenous (IV) delivery of dextrose to patients.</p> <p><b>Methods</b> Prototype transdermal patches were fabricated containing dextrose at three different concentration levels. Each was subjected to an in vitro evaluation aligned with United States Pharmacopeia (USP) standards. Patches were applied to the bottom of a dissolution bath of distilled water, at 32 degrees Celsius and stirred by a paddle at 50 RPM, and samples were taken at three times: 0.5, 1.0, and 1.5 hours (N=216). The samples were 10x diluted in distilled water and analyzed for dextrose concentration using a blood glucometer. Correcting for volume changes, the cumulative dextrose present in the water bath at each time point was calculated and analyzed in comparison to IV rates of infusion (~12 g/hr +- 5%).</p> <p><b>Results</b> Regression functions mapping the data (cumulative dextrose released vs. time) using the Higuchi model of diffusion show nonlinear release kinetics of the transdermal patches as opposed to the linear release kinetics of IV. This means transdermal patches are considerably less accurate (&lt;70% accuracy) in matching the typical IV infusion rate than does an IV line (95% accuracy). However, the daily cost of using patches is only ~\$10 whereas that of IV is ~\$200. Ratios of accuracy to daily cost show that patches are nearly 15 times as cost-efficient than IV for delivery of dextrose.</p> <p><b>Conclusions</b> Because transdermal patches are far more cost-efficient than IV delivery of dextrose, these patches constitute a feasible solution to replace costly IV administration of dextrose. This has revolutionary implications as transdermal patches, unlike IV lines, can be made accessible outside of the hospital, for potential use in malnourished developing countries, by hypoglycemics or diabetics, or even by athletes and the military.</p>	
<b>Summary Statement</b> I developed prototypes of novel transdermal patches and used in vitro evaluation to show they are feasible low-cost alternatives to intravenous (IV) treatment.	
<b>Help Received</b> None. I designed and conducted the development of the prototypes and the experiments by myself.	