POEM for Blood

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Abstract

Demand for blood grows faster than blood donations. Due to aging populations, demand for blood in developed countries rises by 6% to 8% annually, while donations increase by only 2% to 3% annually. Blood collection, a not-for-profit activity conducted by blood banks, consists in matching blood donations with blood demand.

This task is challenging for multiple reasons. First, blood banks do not control how hospitals use and order blood, thus they do not control the demand for blood. Second, blood cannot be bought from donors and no formal "blood market" exists where supply and demand meet to determine a clearing price for blood. Finally, blood is perishable – in the U.S. 4.3% of collected units are discarded because they were not used before the expiry dates. To tackle these challenges, blood banks rely on marketers to avoid blood shortages, while minimizing costs engendered by outdated units.

Focusing on the demand for blood, the operations research literature on blood banks has shown that a "first in, first out" inventory policy minimizes the number of outdated units and blood shortages. Meanwhile, research in information systems showed how information technology helps optimize blood usage. These two streams, however, ignore the challenge of managing blood supply, i.e., donors. Behavioral studies partially address this issue. They focus on the psychological barriers to blood donations, but abstract from the issue of collecting the right of the amount of blood with marketing.

We explore this issue. Specifically, how should blood banks manage marketing resources for optimal blood collections? When are allocation rules from the extant marketing science literature not applicable to blood banks? Moreover, since marketing managers are often endowed with limited advertising budgets, how should they rely on inexpensive online paid, owned and

earned media, i.e., *POEM*, to advertise to donors in lieu of traditional expensive mass media?

To answer these questions and provide managerial guidelines to assist blood banks understand how to use paid, owned and earned online media, we frame the management of blood donations as a dynamic advertising resource allocation problem. More precisely, we propose a novel dynamic model where the volume of blood collected varies with online media that differ on two dimensions, i.e., paid/non paid and easily controllable/non easily controllable, and where, contrary to for-profit settings, the objective of the marketer captures the asymmetric costs between excess and shortage of blood, as well as a cost-free region.

Our results are as follows. First, we show that the traditional inverse allocation rule is optimal for blood banks only in excess and shortage situations, but not when donations are within the cost free region. In that case, the optimal spending rule is to increase spending with donations. Moreover, we find that an increase in effectiveness of advertising instruments could cause the blood bank to spend less on these instruments and not more as prescribed by the extant integrated marketing communications literature in for-profit settings. Next, we show that paid and owned/earned media should be treated differentially in the blood donation management problem. Under certain circumstances, being too successful in owned/earned media can hurt (despite these media being mostly free) because they expose the blood bank to the risk of spoilage, as these platforms cannot (and should not) be shut down quickly when donation levels are too high. Paid media on the other hand can be turned on/off easily to dampen donations, alleviating the risk of spoilage. Finally, we empirically measure the impact of paid, owned and earned media on blood donations using data from a community blood bank.

Key Words: Blood Bank, Paid-Own-Earned Media (POEM), Social/Non-profit Marketing, Optimal Control, Time Series, Bayesian Estimation, Dynamic Linear Model