Modeling the Ethics of Donating Dated Medical Supplies

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Introduction

This work is motivated by the expiration problem lying in the "national reserve supply" or "the reserve," which is a stockpile of medical supplies encouraged by the World Health Organization (WHO) to prepare for public health emergencies. Proposed ways to deal with expiration include rotating to daily use and extending the shelf life, e.g., the Shelf Life Extension Program (SLEP) in the United States. But these two ways are not always economic or feasible (Public Health Agency of Canada, 2009). A seemingly sensible alternative is to donate items in the reserve shortly before they expire (and replace with a new stockpile) to countries where people suffer from scarce medical resources. Research shows that about 70% of injections in developing countries are given with reused needles and syringes (Khamassi, 2012). Yet needle and syringe stockpiles need to be replaced after a number of years sitting in a reserve because eventually the seals are considered non-sterile.

However, due to ethical concerns, donating dated medical supplies is not encouraged nor accepted (WHO, 2011). The concerns mainly lie in whether it is appropriate to use dated products and whether donation would encourage corruption. However, there is now strong evidence (e.g., from SLEP) supporting the effectiveness of dated products from reliable sources and therefore, if done well, such donations could provide huge social benefits for the population who receive them. Certainly, replacing a reused needle with one with a small chance of loss of sterility is likely to significantly improve patient welfare.

Therefore, taking effectiveness as given, this work focuses on corruption and evaluates the impact of potential corruption on donation. We look at "donation-related corruption," which emerges only when donation stocks are made available. This refers to the behavior that bureaus might divert the donation for sale, or that by using donations they might pocket the money initially put aside for purchasing new items. We construct models to examine whether donating dated reserve could benefit the recipient country, considering possible corruption.

Model Description

Our model is as follows. Reserve products that have been well stored for years are donated to an overall impoverished country. There is a local supplier selling the same product. The central administration is in charge of the donation, and there are several regional hospitals in need of the product. Hospitals have different levels of budget, which may come from various sources, for procurement. This initial budget level differentiates the purchasing power and thus makes the product affordable for some hospitals but not for others.

A hospital manager decides whether to get the product or not, and, when buying, how many to get from each source: donation (when available) and the supplier. The total obtained should not exceed its demand. A hospital wishing to get donated product needs to make a request to the central manager who makes the allocation decision. A non-corrupt manager makes decisions based on the social welfare, while a corrupt manager looks at personal gains. The hospital welfare comes from two parts: utility from disposable money after (or not) purchasing (to use on other healthcare), and the health-related improvement associated with using the product. The utility function from available funds is an increasing concave function. The health improvement from using the product is based on the quality and the quantity of the product. We assume that the quality of donated products is no higher than that of the products sold by the supplier (and is likely lower).

We investigate the model in different scenarios. We first consider the base case when there is no donation. We then consider three scenarios given donation is available, to investigate the impact of corruption in different levels. Scenario 1 assumes everyone is ethical, which provides the best-case result. Scenario 2 considers the case that the central manager is corrupt and sells the donation to regional hospitals. Scenario 3 examines the case when regional managers are corrupt and pocket the money saved from donations. Further, we investigate the three scenarios under two different conditions with unconstrained and constrained donation quantities.

Results

When the donation quantity is not constrained, hospitals can get whatever they request. In Scenario 1, where everyone is ethical and makes decisions according to the optimal solution,

it is no surprise that the social welfare improves. In Scenario 2, when the central manager is corrupt and sells the donated goods, the price the manager charges has to be lower than some critical value so it allows improvement in at least some hospitals. Interestingly, the price the central manager charges is not monotone with the donation quality. This suggests there may exist some quality levels that constrain the negative impact of corruption, and so it is not necessarily the case that higher quality is better. In Scenario 3, where hospital managers are corrupt, donation could still be beneficial as long as the proportion of unethical managers is below some threshold value. This threshold value is a non-monotone function of the donation quality, again suggesting that high quality is not always preferred.

When the donation quantity is constrained, hospitals could not always get what they requested and the central manager would adjust decisions to fit the quantity constraint. When all are ethical, the manager would try to achieve the same marginal benefit for hospitals receiving the donated goods, by allocating the same amount to those with a budget less than a critical value. When the central manager is corrupt, the price the central manager charges is set to be high enough such that all available donation is sold but not too high to allow welfare improvement in at least some hospitals.

Summary

We investigate how donation would impact the social welfare of a recipient country, considering possible corruption. We found that donation will typically improve social welfare compared to the base case, even with the presence of corruption, and that quality of donations could be a lever to limit the negative impact of corruption. The results hold no matter whether the donation quantity is constrained or not. These results suggest that WHO should perhaps change its stand on such donation.

References

Khamassi, S. (2012). *Ensuring rational and safe use of injections worldwide: Achievements and way forward*. Technical report, WHO Injection Safety and Related Infection Control.

WHO (2011). *Guidelines for Medicine Donations*. World Health Organization, 3rd edition.

Public Health Agency of Canada (2009). *The management of the national antiviral stockpile: Options report*. Technical report.