Modeling the dynamics of incentives in community drug distribution programs

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Neglected tropical disease (NTD) control programs rely on an army of volunteers, or community drug distributors (CDDs), to distribute preventative drug packages through community and school-based platforms. Both monetary and non-monetary incentives are frequently provided to CDDs, although the impact on program performance is not well documented or understood. This article presents a descriptive framework to help visualize the dynamics of incentives as part of mass drug administration (MDA) campaigns and to guide future research in this area.

Volunteerism and the delivery of drug packages

The availability of safe, easily administered preventative drug therapies now offers an effective strategy for the control and elimination of several neglected tropical diseases (NTDs), but the strategy requires consistent community participation to ensure high treatment coverage among eligible community members. National NTD control programs often rely on participation of volunteers, or community drug distributors (CDDs), in preparation of annual or biannual mass drug administration (MDA) campaigns. Volunteerism, or the involvement of volunteer labor in community service, is not unique to NTD control and elimination programs [1] – large-scale public health initiatives [2] often rely on a cadre of community volunteers to implement activities and reach specified goals.

Volunteers are often provided monetary or non-monetary incentives by programs or communities as part of their MDA participation. Although the definition of an incentive can differ by context, we have adopted its simplest form: something that motivates an individual to perform an action. Despite the predominance of incentives associated with MDA and other health interventions, very few national programs have policies or recommendations regulating the use of incentives to non-salaried health volunteers. In addition, programs continue to struggle with monitoring the impact these incentives have on program performance. This article proposes a descriptive framework to help explain the dynamics of incentives as part of MDA campaigns and to guide future research in this area.

What is the purpose of an incentive?

One of the primary justifications made by program managers for using incentives during MDA has been to encourage volunteer participation and retention over several years of drug delivery, that is, until the time when the program determines that MDAs are no longer needed. Incentives, however, may translate into different types of rewards depending on the social, economic, and professional value and context in which they are received. Such rewards – ‘incentive functionalities’ – can be categorized into three groups: recognition and appreciation, performance-based, and job support (Table 1).

The timing and regularity of when incentives are provided, the types of non-monetary incentives provided, the monetary amounts received, the source of incentives (i.e., external or community-based), and the visibility of incentives (e.g., public vs private exchanges) all become important contextual variables for interpreting how CDDs and program managers perceive and recognize incentive functionality. The potential impact on retaining and motivating participation, and ultimately the ability to achieve targeted goals, may depend on the awareness of a program of this dynamic.

A system dynamics approach to incentives

The causal loop diagram (CLD) presented in Figure 1 provides a framework for visualizing the dynamic causal relationships related to the demand and provision of incentives. It is influenced by a social value orientation (SVO) recognizing the causal relationships between both pro-self and pro-social constructs and their effects on program performance. [3]

Program performance gaps are determined by goal-seeking behavior; the stated goal in the upper left corner of Figure 1 establishes the target a program aims to achieve. A typical NTD control program goal is to achieve 80% program coverage for a targeted disease. The goal of obtaining a certain level of program coverage is assessed against the current state of that coverage to define a program performance gap; this gap is closed if the prescribed activities are successful in increasing the level of performance. The larger the performance gap the greater the pressure to produce action, which typically increases the demand for incentives. The demand for incentives is further influenced by changes in the scope of work or complexity of the tasks volunteers are asked to perform. Action taken towards increasing the level of incentives also increases the economic and professional value of the CDD position. This moves the current state of the program towards the desired level of performance by increasing the likelihood of retaining and/or motivating volunteers to participate in MDAs, thereby improving coverage rates, or the desired level of performance. Of course, improved drug coverage (level of performance) is not only dependent

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on whether volunteers participate but also on the quality of training and supervision received. Equally important is the availability of resources as a determinant of whether incentive levels are increased or decreased.

When the provision of incentives succeeds in moving the current state of a program to the desired state, the performance gap is closed and there is no longer a necessity towards action. The net effect of these relationships is considered to be the result of a balancing loop (Figure 1, B1), where an increase in incentive demand is regulated by producing the desired correction – retaining volunteers and motivating participation in the short term. However, sustained or increased incentive use over time can move programs away from achieving the desired level of performance by diminishing the SVO of volunteers, resulting in a decrease in volunteer retention and motivation to participate. SVO decreases over time as economic and professional considerations are valued above pro-social tendencies. This dynamic results in a reinforcing feedback loop (Figure 1, R1), where the specific cause (e.g., level of incentives) continually reinforces an effect (e.g., SVO) that is either above or below the current state. The balancing loop and reinforcing loop interact in such a way that the desired result initially produced by the balancing loop is offset over time by the actions of the reinforcing loop. The need to take recurring action when performance gaps are not closed, and to capitate on incentive demands, act to drive a fixes-that-fail dynamic that exacerbates attempts to move the current state of the national NTD control programs to a desired state. Under this archetype, program managers behave as though short-term interventions have a beneficial effect, but the unintended consequences deteriorate the long-term trends (http://wwwu.uni-klu.ac.at/gossimit/pap/sd/wb_sysarch.pdf).

The CLD model recognizes that although incentive demand is driven by goal-seeking behavior, in competitive environments it is independently influenced by an additional reinforcing loop (Figure 1, R2). In this reinforcing loop, as incentive levels are increased, the level of expectation to provide incentives gradually causes an increase in the perceived levels of inequity among volunteers, reinforcing the demand for additional incentives. This dynamic

![Figure 1. Incentive causal loop diagram. Positive arrows indicate that if the cause increases, the effect increases above what it would otherwise have been; if the cause decreases, the effect decreases below what it would otherwise have been. A negative arrow means that if the cause increases, the effect decreases below what it would otherwise have been; if the cause decreases, the effect increases above what would happen if the cause changes value. The net impact of certain cause and effect relationships can result in balancing loops that regulate system change from set goals, or reinforcing loops that reflect the growth or decline of a particular state in the system (http://wwwu.uni-klu.ac.at/gossimit/pap/sd/wb_sysarch.pdf). A double line through an arrow (e.g., /) indicates a long-term effect.](http://wwwu.uni-klu.ac.at/gossimit/pap/sd/wb_sysarch.pdf)
is further influenced by competing incentive schemes offered to CDDs by other health programs that exacerbate perceived levels of inequity. As previously mentioned, very few NTD control programs have policies to regulate the provision of incentives; however, the unabated pressure on programs to increase levels of incentives also serves as a driver to encourage the development and enforcement of government policy on incentives. Enforcement of policies regulating the distribution of incentives as part of health sector-wide campaigns has the potential to minimize effects of competitive incentive schemes, thereby reducing the perceived level of inequity among potential volunteers. The corrective action captured in balancing loop B2 limits the growth in incentive demand in R2.

**Practical applications of an incentive CLD model**
The purpose of the incentive CLD is to capture the dynamic cycles of influence caused by the provision of incentives and to identify leverage points in the system to manage incentive demand while moving programs towards closing performance gaps. The archetypal fixes-that-fail dynamic is important for program managers to be aware of, given the limitations of incentives and the changing causal relationships that occur over the life of a program. Without considering the functionality of incentives or managing escalating demand, NTD program managers may inadvertently erode the social value of the CDD position making it increasingly difficult to retain and motivate volunteers.

Over time, the inability to close the performance gap in the face of increased demand for incentives will most likely result in incentive creep, which is the increasing percentage of a program budget going towards CDD incentives. The inability of a program to control incentive creep may reflect failed attempts to fix underlying factors associated with implementation without understanding the dynamic interdependencies regulating the health system when incentives are introduced. In the absence of any regulatory policy on incentives, strategies to address demand may include: (i) simplifying the scope of work of the CDDs; (ii) strengthening SVO among volunteers by reinforcing recognition and appreciation as a function of incentives; (iii) improving the quality and frequency of supervisory visits and trainings; (iv) and limiting external donor support for certain types of incentives.

No standardized package of monetary or in-kind incentives can be guaranteed to ensure motivation among CDDs or reduce attrition, especially if the dynamic of any one incentive is not understood. Although budget planning and development often force standardization of incentive packages across all targeted communities, different communities will need different types of incentives depending on the availability of other work opportunities, previous experience of CDDs, the economic situation of the community, as well as other factors. NTD program managers should be encouraged to scrutinize the elements of this proposed incentive CLD model as they seek to optimize their strategic approach for using incentives to ensure successful MDAs.

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**References**

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**The failure of genomics in biology**

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We live in the age of genomics and have discovered hundreds of thousands of genes of which we understand almost nothing: genomics has failed biology. We need to understand what genes do, something that we have stopped studying. Parasites are different from free-living species, and so they will have genes with novel functions, which we will only discover by studying this directly, not by doing genomics.

Every day more and more genome sequences are read [1,2]. This is a problem because we do not understand what we read. The nucleotide sequence is a straightforward code, from which we can find genes as well as larger genomewide patterns. But, while we can read all this we do not understand what we read; we do not understand what these myriad genes do together to build an organism. In the same way that I (just about) know the Greek alphabet, and can read a Greek sentence I do not understand what I am reading. As we collect ever more genome sequences, we are not learning to better understand them. Worse still, most do not recognise that this problem exists.

Consider this challenge: I choose a species and sequence its genome to produce a completely assembled, high quality, finished whole genome sequence. I now ask you one question: what sort of organism did the DNA come from? Was it a prokaryote or eukaryote; is it a parasite? If it was an animal, terrestrial or aquatic; how many limbs (if any);