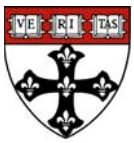

PROGRAM ON THE GLOBAL DEMOGRAPHY OF AGING

Working Paper Series

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March 2010

PGDA Working Paper No. 55
http://www.hsph.harvard.edu/pgda/working.htm

 The Program on the Global Demography of Aging receives funding from the National Institute on Aging, Grant No. 1 P30 AG024409-06.

Universal antiretroviral treatment: the challenge of human resources

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WHO's *Towards Universal Access* 2009 report documents a remarkable worldwide increase in the number of people receiving antiretroviral treatment (ART) – from 3 million in 2007 to 4 million in 2008 – creating hope that with sustained energy, universal ART coverage might be achievable (*1*). At the same time, the report emphasizes many challenges in delivering ART on a more massive scale. One challenge – the number and types of human resources that will be required to achieve universal coverage – deserves attention from a new perspective. In particular, we discuss the effect of feedback from current ART coverage to future ART human resources need on the sustainability of high levels of ART coverage. But in order to think about the future, we first try to understand the past.

How were past increases in ART coverage achieved?

Four possibilities present themselves, none with conclusive evidence: increased inflow of highly skilled human resources, decreased outflow of human resources, task-shifting from highly skilled to lower skilled health workers, or internal shifting of human resources from the general health systems to ART programs. The first seems least likely. According to a study by Hirschhorn et al. (*2*), 1-2 physicians are required to deliver ART to 1,000 patients in developing countries. One million more ART patients in 2008 thus implies a worldwide net addition of 1-2 thousand physicians delivering ART, more than 80% of whom would need to have been added in sub-Saharan Africa (SSA), where WHO estimates the number of people receiving ART increased by 825,000 (*1*). A net gain of 800-1600 physicians in SSA in 2008 seems improbable, since it has been estimated that each year only 5,100 physicians graduate from medical schools in SSA (*3*). Further, a recent article by Kinfu et al. on health worker training in 12 countries in SSA concludes that "in at least 6 of the 12 countries, pre-service training is insufficient to maintain absolute numbers [of physicians, nurses and midwives] even at their current levels" *(4)*.

It thus seems more likely that the large increase in ART coverage in the region coincided with decreased health worker outflow, significant task-shifting, or internal human resource shifting within healthcare systems. First, the large-scale delivery of ART could have mitigated the negative impact of HIV on the stock of health workers *(5)*. For one, in some sub-Saharan African countries sizeable proportions of health workers are HIV-infected *(6)* and it seems plausible that health workers were among the first patients who benefited from improved ART availability in many sub-Saharan African countries, decreasing their morbidity, absenteeism, and mortality. Moreover, ART programs in many developing countries are commonly supported by international organizations, e.g. the Presidential Emergency Fund for AIDS Relief or Médecins Sans Frontièrs, offering salaries that are higher than local levels and facilitating collaborations with renowned academic institutions. It is plausible that many of the

physicians and nurses working today in ART programs would have emigrated had they not been offered attractive ART positions.

Second, within ART programs, tasks may have been shifted increasingly from physicians to nurses *(7)* and from nurses to ART treatment counselors *(8)* . WHO does in fact report that 63% of countries in SSA reporting to WHO, UNICEF and UNAIDS on the health sector response to HIV/AIDS "had developed policies to address human resource shortages through task-shifting strategies" (*1*). However, evidence is still outstanding on the overall extent to which task shifting has occurred, and whether it occurred informally as an ad hoc response to acute staffing shortages or followed formal guidelines and policies *(9)*. And, despite encouraging results from rural Lesotho *(10)*, Rwanda *(7)* and Mozambique *(11)*, the extent to which task shifting is possible without reducing quality of care is not clear. Third, substantial numbers of physicians may have left the general health system to work in ART programs. While there is evidence for such "internal brain drains" *(12)*, the overall size of such movements and their impact on the delivery of primary health care and population health remain unmeasured.

Reasons other than the four above are possible as well. For instance, there is indeed a logical possibility that ART delivery programs had under-utilized physician capacity prior to 2007, or that the productivity of ART delivery per physician has gone up significantly. However, both seem improbable; the first because there is no evidence on record of excess physician capacity, and the second because using the 1:1000 patient/physician ratio, the annual productivity increases would have to have been very large – e.g. 33% if no new physicians were added, 23% if 250 more were added, 14% if 500 more were added, and 7% if 750 more were added.

Who will achieve universal ART coverage?

Regardless of how the jump in ART coverage from 33% to 42% (*1*) has been achieved, if ART is indeed effective in reducing HIV-related mortality *(13)*, future coverage increases will become increasingly difficult. The growing difficulty will be due to feedback from the current pool of people receiving ART to the number of people needing ART in future periods: all else equal, the larger the number receiving ART now, the lower their average mortality, and the larger the future pool in need of treatment. In other words, ART programs will to some extent fall victim to their own success – the more successful they are at reducing HIV-related mortality, the more difficult they will find it to scale up. We have investigated this question more formally in previous work *(14-15)*. Using a mathematical model, we find that estimates of human resource needs that ignore the feedback effect significantly underestimate the

future human resources required to achieve universal ART coverage. For instance, while estimating the size of the ART workforce required for providing universal coverage in SSA within 10 years, we compare a model with feedback to a model without feedback. Our results show that feedback alone implied that 2.45 times more health workers (compared to the non-feedback case) will need to be added to the system every year to achieve universal coverage in 10 years, assuming constant productivity.

Of course, it is possible that there will be counter-factors, mitigating the "victim of own success" problem. For instance, ART coverage may reduce HIV incidence by lowering viral load in treated individuals and thus the average risk of HIV transmission per risky sex act *(16)*. However, countervailing influences may increase incidence. For example, all else equal, increased survival of HIV-positive people due to ART will increase HIV prevalence, and thus the probability of sex between an HIV-uninfected and an HIV-infected person. Moreover, HIV-infected people may become sexually more active as their health improves due to ART and HIV-uninfected people may increase their sexual risk behavior because ART reduces the negative consequences of HIV infection. The net of these competing effects of ART coverage on HIV incidence is currently unknown.

Similarly, it is possible that the number of health workers required to provide high-quality ART to 1,000 patients may decrease over time and with increasing scale of ART programs. Knowledge about how to take antiretroviral medicines and how to deal with the side effects of ART may spread through the population as more patients gain treatment experience, in turn reducing interaction times between patients and health workers. Technological advances, such as combination pills or improved patient management systems, and increasing health worker experience in providing ART could further reduce the health worker-to-patient ratio required for quality ART. New treatments, such as a therapeutic vaccine, may improve ART efficacy and decrease the need for patient follow-up visits *(17)*. Finally, depending on the nature of a country's general health care system *(18)* new organizational models of care may evolve (such as integration of vertical ART programs into general health systems or increased participation of the private sector in ART delivery *(19)*) and improve the efficiency of ART care.

Although such hypothesized counter-factors are distinct possibilities, they are not prudent bases for planning and expectation setting.

Conclusion

There is a great need to document and study how past increases in ART coverage have been achieved, for instance, by assessing health worker performance using surveys of ART facilities *(20)*. However, such

study alone is not enough. Some of the most important factors determining the long-term progress towards universal coverage – such as "victim of own success" mechanisms – may not be understood through such study, because they may only become apparent with time and as ART coverage further increases. Uncertainties around the definition of ART need, such as increases in the CD4 count threshold for treatment eligibility, and ART-related health problems that may arise in the future, such as widespread viral resistance, may further exacerbate the challenge of predicting future need through the study of the past outcomes *(21)*. Health policymakers need to anticipate these factors with the aid of models, allow for significant uncertainty in their ART strategies, and set realistic expectations for the magnitude of resources required for universal ART coverage.

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