Disability Grant terminations and virologic and immunologic response to ARV treatment

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Abstract

In South Africa, persons too ill to work qualify for a disability grant (DG). The disability grant may have a disincentive effect, with ARV patients facing the dilemma of trading off the stable source of income in the form of the disability grant against their current and/or future health and adhering sub-optimally to treatment so as to not lose the grant. This paper employs longitudinal, panel data from two Free State cohorts of public sector ARV clients to determine how disability grant terminations may impact on virologic and immunologic treatment outcomes. Findings from the quantitative analyses suggest that the termination of access to a disability grant translates into poorer treatment outcomes, particularly in the first three months of ARV treatment. Social welfare officers and health care teams should therefore take particular care when deciding to refuse applications for social assistance early in the ARV treatment career.

Keywords

HIV/AIDS · Antiretroviral therapy · Social security · Clinical outcomes · South Africa

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1. Introduction

South Africa faces the largest HIV burden in the world and currently has the largest ARV treatment programme in the world (UNAIDS, 2010). By February 2011, an estimated 1.4 million people were receiving treatment as part of government's ARV treatment programme, with a total of 2,205 facilities being accredited to provide ARV treatment (Motsoaledi, 2011). Treatment coverage, according to earlier goals published in the country's Comprehensive Plan and National Strategic Plan (NSP) is anticipated to rise to approximately 4 million over the next few years (National Department of Health, 2003; South African National Aids Council, 2007). According to Russell et al (2007: 344), "considerable challenges remain for people who are trying to live with HIV as a manageable chronic condition [… and the] future for those on ART depends not only on the provision of medicine but also on economic and social support for rebuilding lives and livelihoods." For this reason, it is crucial to investigate the potential impact of income support on ARV treatment success.

The question of the potential role of income support in an ARV treatment programme moreover is of particular relevance in South Africa, where individuals too ill to work qualify for a specific form of income transfer, or, as it is called in South Africa, a social welfare grant, namely the disability grant (DG). Income support may be important in sustaining treatment, particularly in the case of ARVs, where medication should be taken with meals. In fact, the country's 2007-11 National Strategic Plan (NSP), made a(n unsuccessful) case for the "introduction of a [general] chronic diseases grant that will promote adherence by supporting people with long term medical needs" (South African National Aids Council, 2007). More specifically, Nattrass (2006a/b) highlighted the fact that the disability grant may have a disincentive effect. ARV patients face the dilemma of trading off the stable source of income in the form of the disability grant against their current and/or future health and adhering sub-optimally to treatment so as to not lose the grant. The resultant sub-optimal adherence to ART and the resultant increase in drug-resistance, which require more expensive second line treatment (Calmy et al., 2004: Long et al., 2010), stand to negatively impact on the long-term sustainability and cost-effectiveness of ART. The available empirical evidence, though, present a puzzle. Qualitative studies on the topic all provide support for Nattrass' (2006a) argument, reporting that a substantial number of patients,

health care providers and other stakeholders all reckon that the lapsing of a grant will impact negatively on treatment adherence and outcomes (Goudge & Ngoma, 2011; Yoder et al, 2009). On the quantitative side, though, one singular study on this topic reports no evidence of such disincentive effects in a cohort study of ARV clients in Khayelitsha, Cape Town (Venakataramani et al., 2010). Additional evidence, therefore, is required to shed light on this important policy question. This paper employs longitudinal, panel data from two Free State cohorts of public sector ARV clients to determine how disability grant terminations may impact on virologic and immunologic treatment outcomes.

2. The South African social security system, the disability grant and HIV/AIDS

At present, total social protection expenditure in South Africa comprises 14.8% of the country's total consolidated government expenditure, of which almost two thirds (66.5%) are spent on income transfers. Equivalent to 3.3% of Gross Domestic Product (GDP), more than a quarter of the South African population benefits from income transfers (National Treasury, 2011). At the outset of the new millennium, the reach and cost of the disability grant, one of five income transfers paid out in the large-scale, non-contributory South African social security system (Gray, 2006), amounted to a total of ZAR4 million paid to approximately 627 000beneficiaries. Over the past decade, the nominal value of the disability grant doubled, increasing from R540 to R1,080 per month (National Treasury, 2011). By the 2010/11 financial year, as the HIV/AIDs epidemic took its course, the disability grant's reach more than doubled, with almost 1.3 million individuals receiving a disability grant, which cost the fiscus just over ZAR17 billion per annum, a figure that according to the Medium-Term Expenditure Framework (MTEF) published by the National Treasury is projected to increase to ZAR20.6 billion per annum by 2013/14.

[Figure 1]

The country's Social Assistance Act (2004) states that, "A person is… eligible for a disability grant, if he or she… is owing to a physical or mental disability, unfit to obtain by virtue of any service, employment or profession the means needed to enable him or her to provide for his or her maintenance". (Despite anecdotally called the 'HIV' or 'HIV/AIDs' grant and even defined

as such by some researchers, the Act makes no reference to HIV/AIDS as a condition of eligibility.)

In the Free State province, applications for the means-tested disability grant are made to the South African Social Security Agency (SASSA), based on the recommendation of a physician (or, in earlier years, in other provinces, a larger assessment panel comprising a multi-disciplinary team) (Simchowitz, 2004). Evidence moreover suggests that South African physicians, who together with officials from SASSA determine eligibility for this form of income support, in many instances use the disability grant as a poverty-alleviation intervention and approve grants based on criteria of socio-economic needs rather than clinical or medical criteria only.[1] In terms of the latter, national guidelines for ARV eligibility on AIDs stage, and in particular CD4 counts are sometimes used by physicians as decision-making criteria (Bateman, 2006; De Paoli et al., 2011). Successful applicants may be awarded the full disability grant or part thereof, depending on the means-test, for either a 'temporary' grant of 12-months or a 'permanent' grant, which applicants needs to renew every 5-years (De Paoli et al., 2010).[2] By March 2011, 82.3% of disability grant holders received a one-year, temporary grant, while 17.7% received a five-year, permanent grant. The corresponding figures for the Free State province are 78.3% and 21.7%, respectively (SASSA, 2011).

[1] In cases where CD4 count is employed to determine eligibility for a disability grant, the recent implementation of revised ARV eligibility criteria to now increase coverage to all HIV-positive persons with a CD4 count of 350 or below and the goal to by 2030 provide treatment for all HIV-positive persons, means that the population eligible for ARV treatment is estimated to increase substantially in future, with the result that an even larger proportion of clients in the ARV treatment programme, more specifically those qualifying for receiving a disability grant, will face this health-income trade-off.

[2] Applicants are required to submit a medical assessment report confirming their disability with their application. Medical reports may not be older than three months at the date of application (National Department of Social Development, 2010). In the 2010/11 financial year, the income threshold of the means test was R31,296 per annum and the asset threshold R518,400. Successful applicants with an income below the so-called 'disregard' level of R13,680 per annum receive the full grant of R1,080 per month. At higher income levels, up to the threshold, above which applicants do not qualify for the disability grant, the grant level falls (National Treasury, 2011: 101). Apart from the means test and medical assessment, conditions for receiving the disability grant include the following: a South African citizen, permanent resident or refugee, resident in South Africa, aged 18-59 years, not maintained or cared for in a State Institution, not personally in receipt of another social grant (National Department of Social Development, 2010).

3. Data

The data employed in the quantitative analysis that follow, use patient-level observations collected as part of two longitudinal, cohort studies of public sector ART clients conducted in the Free State province of South Africa during the period 2004-10. Below, follows a briefly description of each study:

3.1 CP6 cohort

The Ethics committee of the Faculty of Humanities, University of Free State (UFS) approved the study protocol of '*Component Project 6*' (CP6), a component of larger set of studies conducted by researchers from the University of Free State's (UFS) Centre for Health Systems Research and Development (CHSR&D), the University of Cape Town's (UCT) Lung Institute, and CIET. Study participants were sampled randomly from a list of patients who were eligible to commence ART during the first two months after the launch of the ARV treatment programme in each of the province's five health districts. In each district, eighty patients were sampled randomly from these lists proportional to the numbers at each health care facility who had commenced treatment or were waiting to initiate treatment.[3] Trained enumerators conducted structured, face-to-face baseline interviews with ART patients between August 2004 and June 2005. Written, informed consent was obtained from study participants by the nursing personnel at the respective clinics, as well as by the enumerator. Where cohort patients were lost to follow-up in subsequent survey rounds, replacements were sampled randomly from the original sampling frame. Enumerators again obtained written, informed consent from study participants prior to each follow-up interview. Five rounds of follow-up interviews were conducted with patients during the period January 2005 to December 2008. The median time between consecutive interviews was 6.7 months [IQR 5.6-8.4 months], with actual timing between interviews varying due to logistic and practical constraints. In total, 1,844 interviews were conducted with 452 individual patients who

[3] The public sector ART programme did not commence simultaneously in all five health districts. The original sampling frame excluded patients eligible for ART (i.e. CD4 $\leq$ 200 and/or WHO AIDS stage 4), but who were not certified as ready to commence with treatment by a physician, in many cases due to patients having to first complete their tuberculosis treatment. Thus, the results cannot be generalized to all patients eligible for ART, but rather to public sector patients ready to commence ART. In Xhariep district, the sampling frame included < 80 patients: as a result, all treatment and non-treatment cases were included in the study for this particular district.

were eligible for and ready to commence ART. A total of 195 patients (n) were interviewed in all six survey rounds. By the final round of follow-up interviews, 189 patients had been lost to follow-up, primarily due to mortality among study participants (43.6%), refusal (17%) and unknown whereabouts (12.7%), which translates into an aggregate attrition rate of 41.8%.

3.2 FEATS cohort

The Effective Aids Treatment and Support in the Free State (FEATS) study, a prospective cohort study and experimental study with a combined group time-series, quasi- or field experiment and Zelen-type double randomized consent design[4], was approved by the Ethics committee of the Faculty of Health Sciences (UFS) [ETOVS 145/07].[5] The open enrolment into this prospective, experimental study was managed by ARV nurses employed at each of the 12 larger phase-I ART clinics in the Free State province. Eligible ARV clients had to be adult (18+ years), had to have initiated ART in the past month, and had to reside in the local community where the particular clinic is based. The study comprised patient- and household-survey component, including individual interviews with household members aged 10 and above. Trained enumerators conducted structured, face-to-face baseline interviews with ART patients and patient households during October 2007 to October 2008. Written, informed consent was obtained from study participants by nursing personnel at the respective clinics, as well as by the enumerator. Patients and patient households lost to follow-up were not replaced, as was the case in the CP6 study. Enumerators again obtained written, informed consent from study participants prior to each follow-up interview. Two rounds of follow-up interviews were conducted with patients during

[4] In this type of study design, participants are only informed of and offered one specific, randomized treatment assigned to them. Such a design is appropriate given that: blinding is not practical or possible; the use of classical randomization and informed consent procedures significantly threatens internal validity; interventions are highly attractive; the control group receives standard care; the study focuses on a clinically relevant objective(s) and offers important new insights (Kaptchuk, 2001; MacLehose et al, 2001; Rains & Penzien, 2005).

[5] The experimental component of the FEATS study comprised a peer adherence and nutritional support intervention. The trial is registered in South Africa [DOH-27-0907-2025] and with the United State's National Institutes of Health (NHI) [NCT00821366]. The FEATS study also includes a comparison group of 212 comparison households sampled from each of the local communities served by the 12 health clinics. These households were interviewed using the same survey instrument for patient household, the aim being to investigate the nature and magnitude of a range of positive (e.g. time use and energy consumption and household welfare) and negative externalities (e.g. sexual dis-inhibition) of ARV treatment. As this particular paper focuses on the use of the pooled datasets from the two cohort studies to investigate the impact of the disability grant access on comparable measures of treatment adherence and outcomes, the impact of the FEATS experiments on adherence and treatment outcomes is not investigated here, nor is the evidence of the latter broader impacts of ARV treatment.

the period March 2009 to July 2010. The median time between consecutive interviews was 11.7 months [IQR 10.6-15.9 months]. A total of 1,588 interviews were conducted with 653 individual patients, 422 of whom were interviewed at both follow-ups. By the second and final round of follow-up interviews, 218 patients had been lost to follow-up, primarily due to mortality among study participants (42.4%) and unknown whereabouts (34.1%), which translates into an aggregate attrition rate of 33.6%.

3.3 Socio-demographic and other characteristics of study populations

Table 1 below report selected baseline characteristics of the study populations in each study cohort. Age, dwelling type, highest level of education, household size and dependency ratio do not differ significantly by study cohort. Given the differences in the study design, in particular in sampling design (refer to above discussion), it is not surprising that the two study populations differ significantly on various other factors. Females and Africans were statistically significantly more likely to be recruited into FEATS than into the CP6 study. Similarly, study participants recruited into FEATS at baseline were significantly more likely to be unmarried compared to CP6 study participants. Median pre-ART CD4 counts in FEATS study participants were statistically significantly higher than in CP6 study participants. While levels of employment were statistically significantly higher in the FEATS cohort, study participants in the CP6 cohort reported significantly higher monthly employment incomes.

[Table 1]

The most likely cause of these significant socio-economic differences is the fact that nursing staff at the relevant clinics played an important role in the FEATS study's recruitment process, whereas CP6 study participants was selected randomly from a sampling frame constructed for each health district. With the exception of employment status, the results suggest that more needy clients, in other words clients that in nurses' opinions would be more deserving in respect of receiving the randomized peer adherence and nutritional support interventions, such as single, African women, were more likely to be recruited than others, representing an important potential source of selection bias. The significant difference in baseline CD4 counts make sense for two reasons: on the one hand, it reflects the wait-and-see perspective observed among some clients,

with those not as ill waiting longer prior to enrolment so as to witness the health impacts of other clients. On the other hand, treatment was prioritized for more ill patients with lower CD4 counts when the ARV treatment programme was first launched as a means of implicit rationing (Jacobs et al 2008). In the subsequent pages, these patient-level data are pooled to investigate the impact of access to a disability grant and transitions therein on selected subjective and objective measures of ARV treatment success, using appropriate statistical and econometric tools.

3. Method

In order to maximize the statistical power and increase the chances of detecting statistically significant impacts of disability grant terminations on virologic and imunnologic outcomes, which can only be observed in sufficient numbers in large cohorts, the data from the two cohorts were pooled. The analysis, as explained elsewhere, is restricted to the sub-sample of study participants in each cohort who received treatment, which comprise a total of 3,005 observations, 1,584 from the CP6 cohort and 1,421 from the FEATS cohort[6]. The treatment cases observed in all survey rounds, amount to 138 (N=828) and 375 (N=1,125) in the CP6 and FEATS study cohorts respectively, translating into a balanced panel dataset of 1,953 observations for n=513 study participants. Statistical and econometric analysis is restricted to comparable outcomes in the interview and patient record data and comprises the following:

Firstly, reported access to a disability grant and disability grant terminations are compared over treatment duration for respondents on ARV treatment. Current access to a disability grant (yes/no) is based on respondents' answer to the question: "Do you currently receive a disability grant from government?" Terminations in disability grants were coded from the former outcome as observed during consecutive interviews within a conventional transition matrix. In the FEATS study, the inclusion of a retrospective question in the individual questionnaire that asked respondents if they previously received a disability grant (yes/no), allowed the identification of additional transitions: 49 disability grant terminations were identified in this manner, increasing the total number of disability grant terminations observed in the pooled data set by 26.3%.

[6] Not interrupting or stopping one's ARV treatment represent an important measure of treatment success. In fact, default or, alternatively, retention represents a problematic aspect of ARV treatment programmes in developing countries (Rosen et al, 2007; Tassie et al, 2010).

Secondly, CD4 counts and the natural log of viral load (RNA) are compared across treatment duration, using one-way analysis-of-variance (ANOVA). CD4 counts and viral loads obtained from patient records were matched with interview data in the following manner: bio-markers were matched to an interview if observed within one month (30-days) prior to the interview or up the three months (90-days) afterwards, based on test and interview dates. Based on the matched clinical markers, virologic suppression (RNA<50 at 3+ months of ARV treatment) was employed as an additional treatment outcome (Barth et al 2011; Bartlett & Shoa, 2009; Dahab et al 2010; Wisaksana et al 2010).[7]

Thirdly, each of the five clinical treatment outcomes described above is compared across the binary disability grant transition variable, where zero (0) represents individuals who are still receiving the disability grant and one (1) represents individuals whose disability grant has been terminated in the recent past. Chi-squared tests are used to determine if dichotomous outcome variables differ statistically significant across DG transitions, whereas t-tests are used to compare the mean and median values of continuous outcome variables across disability grant termination status. To be deemed significant, differences need to be statistically significant at least at the 95% level.

Finally, multivariate regression models are employed to determine to what extent disability grant terminations in the recent past impact on virologic and immunologic response to ARV treatment. One set of regression models are estimated with grant termination as the independent variable of primary interest. In addition, disability grant termination variable is interacted with time on ART

[7] Studies of the clinical benefits of treatment sometimes employ two additional treatment outcomes, namely virologic failure (R>400 at 6+ months of ARV treatment) and immunologic failure (CD4<100 at 6+ months of ARV treatment) (Barth et al 2011; Bartlett & Shoa, 2009; Dahab et al 2010; Wisaksana et al 2010). In these two cohorts, virologic and immunologic failure, at 13.4% and 4.0%, respectively, do not differ statistically significantly over treatment duration. Virologic virologic and immunologic failure, though marginally higher in study participants whose grants were terminated in the recent past, does not differ statistically significantly compared to study participants still receiving a disability grant. The small numbers of virologic and immunologic failures observed in the data also precluded the estimation of a statistically significant pooled or RE regression model. In terms of virologic failure, similar results are reported in other studies for virologic failure. In Botswana's national ARV treatment programme, virologic failure had occurred in 8.7% and 9.9% only of patients at one and three years of treatment, respectively (Bussmann et al, 2008), while in a South African cohort study, 15.8% of patients exhibited virologic failure at 12 months (Akileswaran et al, 2005). In another South African cohort, 12.7% of study participants showed virologic failure at six months on treatment (Dahab et al, 2010).

to determine whether the timing of disability grant terminations in different phases of the ARV treatment career matter for virologic and immunologic response. Regression models include the following independent, control variables: age, sex, marital status, population group, education, employment status, dwelling type, baseline CD4 count prior to ARV initiation, treatment duration, study cohort and district.[8] Multivariate regression models, which take on a dynamic form, with past transitions in disability grant access being regressed on current measures of ARV treatment success, are estimated using linear and logistic random-effects (RE) regression models. RE models are used, given the dynamic nature of the treatment variable and the number of important invariant explanatory variables in the model specification (e.g. sex, study cohort, pre-ART initiation CD4 count). Goodness-of-fit is gauged against the relevant Wald chi-squared test, while Breusch and Pagan Lagrangian and likelihood-ratio (LR) specification tests are employed to compare the RE regression models with the corresponding pooled regression models.

4. Results

Current access to a disability grant varied statistically significantly over treatment duration. After three months, access increased markedly, but then declined to below 50% in the 2nd and 3rd years of ARV treatment (Figure 2a). Beyond three years, grant access rose to 70%. Venkataramani et al (2010) also report relatively high rates of grant access, 50% at five years on ARV treatment.

[Figure 2a-b]

A total of 235/1,005 or 23.3% disability grant recipients reported at a consecutive interview that they have lost their disability grant. (In the only comparable study, De Paoli et al (2010) report 42% of study participants in Khayelitsha, Cape Town to have experienced a grant loss, or in their words, a 'termination' of the disability grant.) Figure 2b illustrates that disability grant terminations occurred at different stages of the ARV treatment career. Most notably, almost seven in ten ARV clients interviewed within three months of having initiated ARV treatment

[8] As a result of the relatively high refusal rate in response to questions on employment income (14.5%), regression results are not adjusted for individual employment income, but rather for individual employment status. Household income, which represents the ideal control variable and which would allow analyses of the household level impact of grant terminations, is not measured in the CP6 cohort study. The FEATS study, which includes a full, household-level living standards measurement survey, does present scope for such analysis.

reported having had access to a disability grant previously but not receiving the grant any longer. This particular finding suggests that grant recipients not yet on ARV treatment either delay seeking ARV treatment until just before their disability grant lapse or that enrolled clients having entered the ART programme and are awaiting treatment, which may be a lengthy process, are awarded a short-term, one-year disability grant, which expires by the time they commence their ARV treatment. (Given the nature of the study design (i.e. clients were only interviewed after having initiated ARV treatment), it is not possible to determine which of the two factors explain this finding.) The proportion of grant terminations then declines markedly in latter phases of the treatment career, declining to below 10% in the 4th year of ARV treatment, suggesting that successful applicants start receiving a newly awarded grant directly after a previous grant lapse and/or that a fairly large number applicants were awarded five-year grants.

[Figure 3a-c]

Figures 3a-c present strong evidence for the expected clinical benefits of ARV treatment, both in immunological (CD4) and virological (RNA) response. More specifically, CD4 counts continue to rise as ART duration increases, while viral load drops sharply after three months, then leveling off in later phases of the treatment career (Figure 3a). Figure 3c shows that more than six in ten study participants had achieved virologic suppression within the first year of treatment. Beyond one year of ARV treatment, virologic suppression is statistically significantly higher than at 3-12 months, peaking at 87.6% in the 4^{th} year of ART treatment. Similar clinical treatment responses have been observed in other cohort studies: 63% of patients enrolled in an ARV treatment programme in rural South Africa had achieved viral suppression at a median three years after ART initiation (Barth et al, 2011).

[Figure 4a-c]

Figures 4a and 4b illustrate that viral load and CD4 counts are statistically significantly lower and higher, respectively in study participants who experienced a disability grant termination than in study participants who were still receiving a disability grant. Virologic suppression also differ statistically significantly in study participants still receiving a disability grant and study

participants who reported not receiving a disability grant any longer (Figure 4c). Virologic suppression is lower for disability grant terminations than for grantees.

[Table 2]

According to the regression results in Table 2, CD4 count, although not significantly impacted by grant termination, is statistically significantly lower in study participants who reported a disability grant termination at ARV treatment initiation. CD4 counts, on average, are 103.8 lower in study participants whose disability grant was terminated than in study participants receiving a disability grant. The same is true for viral load. The natural log of viral load (RNA) is statistically significantly higher in study participants who reported a disability grant termination at ARV treatment initiation, but not for grant terminations in general. For viral suppression though, both grant terminations in general and grant terminations at initiation of ARV treatment are statistically significant (Table 2).

5. Limitations

Study results should be interpreted with caution, given the following caveats: *Firstly*, the asynchronous nature of data on disability grant access and clinical bio-markers of treatment success, which were collected from patient interviews and paper-based and electronic patient records, considerably constrained the statistical power of analyses on the impact of income support on immunological and virological outcomes. Matched CD4 and RNA bio-markers were available for 1,700/3,005 or 56.6% and 1,601/3,005 or 53.5% of interviewed respondents who had a matched CD4 or RNA marker, respectively. *Secondly*, the evidence presented here is based on data collected from ARV clients in one province only, namely the Free State. In addition, the data from the FEATS study does not represent a representative sample of patients initiating ARV treatment in 2007/08. Furthermore, both studies suffer from attrition bias, as does the FEATS dataset, in particular with regards to losses in a disability grant, which significantly increased the likelihood of attrition. As a result, the prevalence of such transitions and the impact of the loss of a disability grant may be underestimated. The non-random nature of the FEATS baseline sample and the presence of attrition bias also means that the findings cannot be generalized to South Africa's public sector programme at large, or those in other provinces.

In the *third* instance, the fact that both study designs were different may also warrant the separately analysis of each cohort's dataset, the advantage of which includes the incorporation in the analysis of a variety of adherence and treatment outcome measures unique to each of the individual studies, including default/retention, which represents a key programme outcome.

Lastly, it is important, to note that the analysis presented here represents a rather crude approximation of a highly complex chain of cause-and-effect in which current expectations regarding the timing of future streams of disability grant income, which plays out at the household rather than the individual level, depending on the extent and nature of economic agents' rationality, may impact adherence, health status and treatment outcomes observed in the past, present and future in a highly dynamic fashion. Most crucially, these data and the analyses presented here cannot distinguish whether the illustrated impacts on treatment outcomes are the result of conscious behavioural modification driven by an explicit trade-off of health against income, a rational response to and consequence of a substantial income shock, or a combination thereof. Further analyses of the FEATS data, which collected data on the duration of disability-grant spells as well as a wealth of household-level data, including detailed information on income sources of patients and other household members and food expenditure and food security, will be important in further investigating the causal mechanisms through which disability grant terminations translate into deteriorating health status and poorer clinical treatment response. The application, of advanced econometric methods such as propensity score matching (PSM) and regression discontinuity design (RDD) to these observational data will be equally important in confirming the nature of these causal pathways and their nature and magnitude. Together with the results reported here, this research will help inform policymakers on the impact of the disability grant on ARV treatment success in the short to medium- and even longer-term.

6. Discussion

The quantitative findings presented in this paper suggest that the termination of access to a disability grant translate into poorer treatment outcomes, particularly in the first three months of ARV treatment, thus suggesting that South Africa's disability grant does in fact impact

negatively on ARV treatment outcomes, other things being equal. These results most likely reflect the consequences of the large income effect of the loss of a disability grant, in particular for households and their extended families, as documented by Booysen & Van der Berg (2005), Collins and Leibbrandt (2007), Phaswana-Mafuya et al (2009), De Paoli et al (2010) and Venkataramani et al. (2010). This in the context of a social-assistance programme whose impact on income poverty, especially amongst the poorest, remain substantial (Van der Berg et al, 2010). Furthermore, the resulting loss of income may have other unintended consequences, including social and psychological ramifications such as effects of self-esteem, stress and grant termination for disclosure (De Paoli et al, 2010), which requires further investigation.

De Paoli et al (2010: 13-14), however, came to a very different conclusion based on findings from a mixed-methods study of PLWHA and other stakeholders in Khayelitsha, Cape Town, where both the quantitative and qualitative evidence suggest that, "ARV adherence rate remained consistently high for HIV-positive participants in the panel surveys and according to those interviewed in the qualitative study.. [and that despite] constant rumours that some people had stopped taking their ARVs in order to qualify for the grant and alleviate their financial problems… when they were asked whether they would stop taking ARVs in order to get sick and therefore qualify for the disability grant again, none of the participants said that they would engage in this kind of practice. One HIV-positive man who participated in the study stated it succinctly, 'Oh no, I take my drugs every day, because I do care about my treatment and all that since I started to take my treatment […]. It's about my life!' "[9]

There is some evidence, therefore, to support the proposal in the current version of South Africa's National Strategic Plan (NSP) for the "introduction of a chronic diseases grant that will promote adherence by supporting people with long term medical needs" (National Department of Health, 2007). Such policy, however, based on fairness and equity, should target all chronic diseases equally, including tuberculosis and diabetes, to avoid the dangers of "AIDs exceptionalism" (Smith & Whiteside, 2010; Forman, 2011). Nattrass (2006b), argues for the

[9] De Paoli et al (2010: 14) report that study participants made references to some apparently more "subtle" ways in which PLWHs may 'tip the scale' to lower their CD4 counts without stopping ARV use completely. Examples included increased alcohol consumption prior to clinic visits when bloods are drawn for CD4 counts and "skipping some days of treatment" but not stopping ARV treatment altogether.

introduction of a Basic Income Grant (BIG) or Employment Guarantee Schemes (EGS) to fill this gap in the social security net, which does not provide income support to unemployed adults, only to the disabled. Such policy will circumvent the former concerns regarding equity and fairness. In the current policy environment, however, social welfare officers and health care teams should take particular care when refusing applications from patients with a low socio-economic status for the renewal of a disability grant early in the ARV treatment career. In addition, attention should be paid to instituting transitional welfare to-work programmes into South Africa's social welfare programmes (Braveman, 2006).

Acknowledgement

We thank the study participants and the fieldwork staff as well as the Free State Department of Health (FSDOH) and National Health Laboratory Service (NHLS). The study was funded by the following institutions: Australian Agency for International Development (AUSAID), Canadian International Development Agency (CIDA), Development Cooperation Ireland (DCI), Department for International Development (DfID), Canadian International Development Research Centre (IDRC), Joint Economics, Aids and Poverty Programme (JEAPP), United Nations Development Programme (UNDP), United States Agency for International Development (USAID); Research Committee of the World Bank; The Bank Netherlands Program Partnership; WB-DfiD 'Evaluation of the Community Response to HIV and AIDS'; Programme to Support Pro-Poor Policy Development (PSPPD); a partnership between the Presidency, Republic of South Africa and the European Union; Health Economics and Aids Research Division (HEARD) at the University of Kwazulu-Natal; University of the Free State (UFS); South Africa's National Research Foundation (NRF). The findings, interpretations and conclusions in the article are those of the authors and do not reflect the views of funding agencies.

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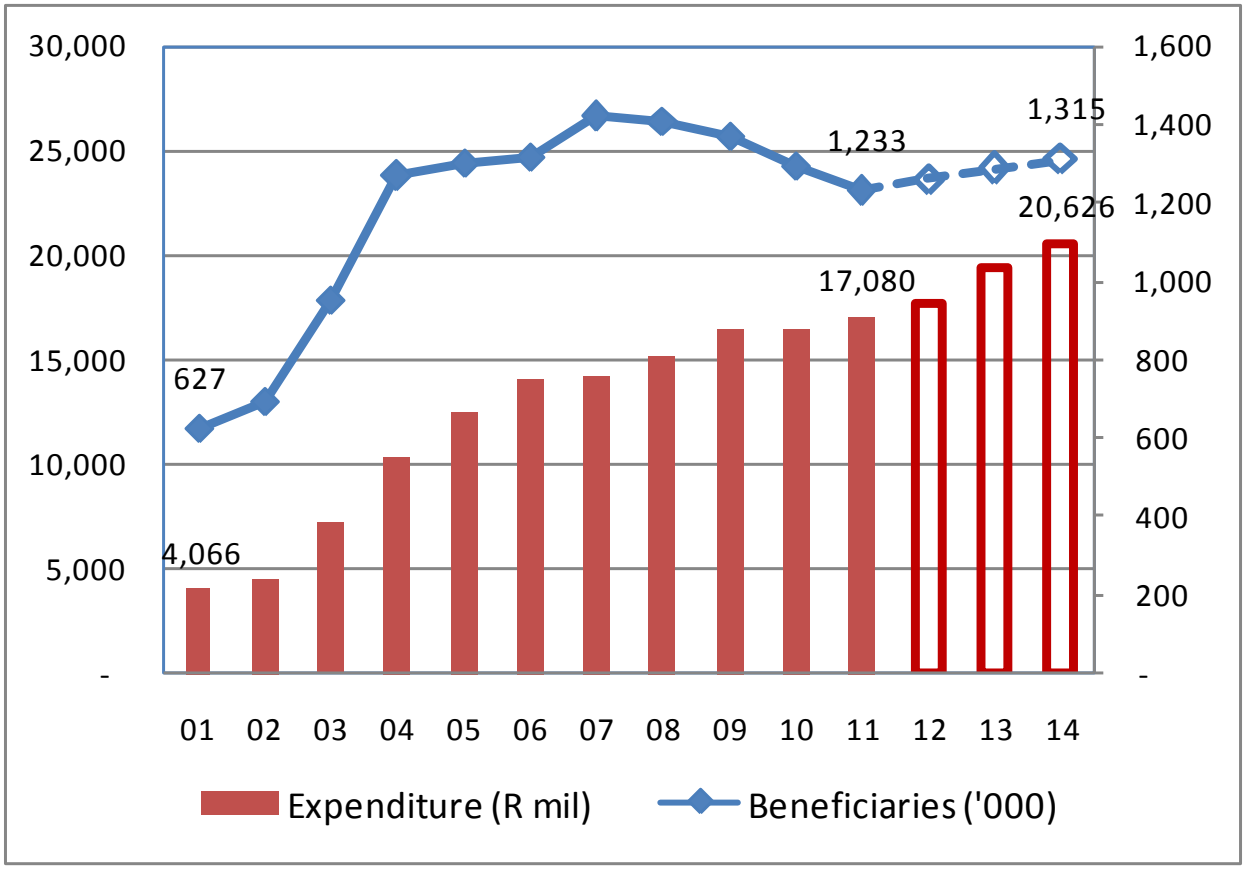
Figure 1: Disability grant beneficiaries and total annual spending (2001-14)



Note: Figures represent beneficiary numbers and total annual expenditure as reported for each financial year. The financial year runs from April to March of each year. Expenditure is reported in nominal terms. Figures for 2001-10 reflect final expenditure, while the 2011 figures are provisional. The 2012-14 figures reflect the beneficiary numbers and expenditure as reported in the Medium Term Expenditure Framework (MTEF).

Source: National Treasury (2011).

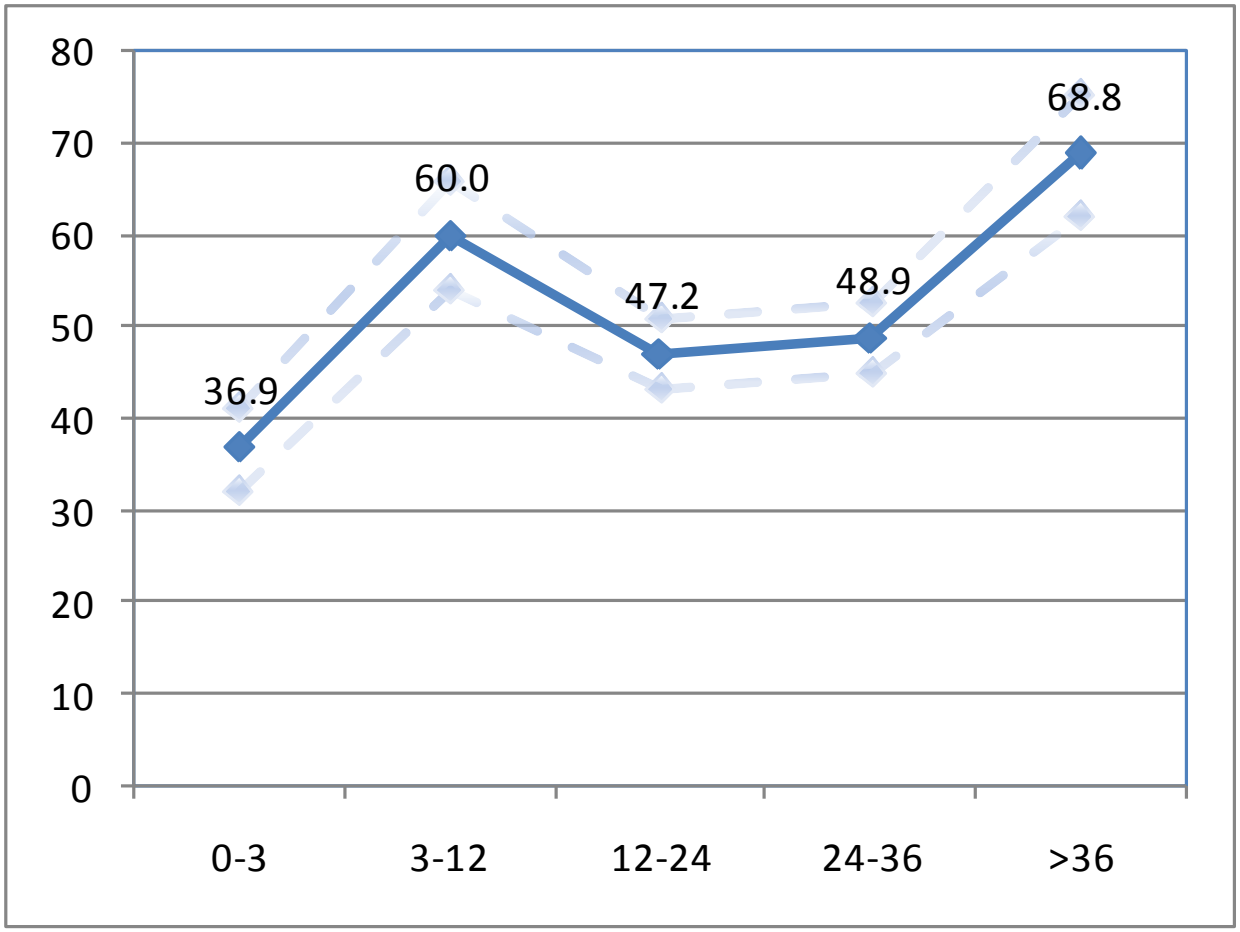
Table 1: Selected baseline characteristics, by study cohort

	CP6:	FEATS:	
Median age (years) [IQR]	36.9 [31.6-44.2]	37.0 [32.0-43.0]	
Female (%)	64.7	76.5	***
African (%)	95.7	98.4	**
Marital status:			
Single	46.5	66.7	***
Not cohabiting with partner	21.4	9.9	
Cohabiting with partner	31.9	23.3	
Total	*100.0*	*100.0*	
Dwelling:			
Formal	71.6	73.6	
Informal	21.0	21.1	
Traditional	7.2	5.2	
Total	*100.0*	*100.0*	
Education:			
None	3.2	2.6	
Primary	24.2	27.5	
Some secondary	43.7	46.9	
Grade 12	23.4	20.4	
Tertiary	5.2	2.4	
Total	*100.0*	*100.0*	
Median household size [IQR]	4 [2-5]	3 [2-4]	
Mean dependency ratio (%)	30.0	29.6	
Median baseline CD4 [IQR]	98 [54-149]	127 [72-182]	***
Employment status:			
Not economically active	69.2	63.3	***
Unemployed	15.7	10.7	
Employed	14.9	25.9	
Total	*100.0*	*100.0*	
Monthly employment income [IQR]	1,275 [800-2,400]	960 [560-1,500]	**

Note: Results are for the 371 and 653 patients recruited into the CP6 and FEATS study cohorts in 2004/05 and 2007/08, respectively. Exclude replacements in the CP6 study cohort (refer study design and sampling strategy). Baseline CD4 values represent the CD4 count observed closest to but prior to ARV treatment initiation. Some percentages may not add up to 100% across categories in the absence of rounding. One, two and three asterisks denote differences that are statistically significant at the 10%, 5% and 1% levels, respectively.

Source: Authors' own calculations.

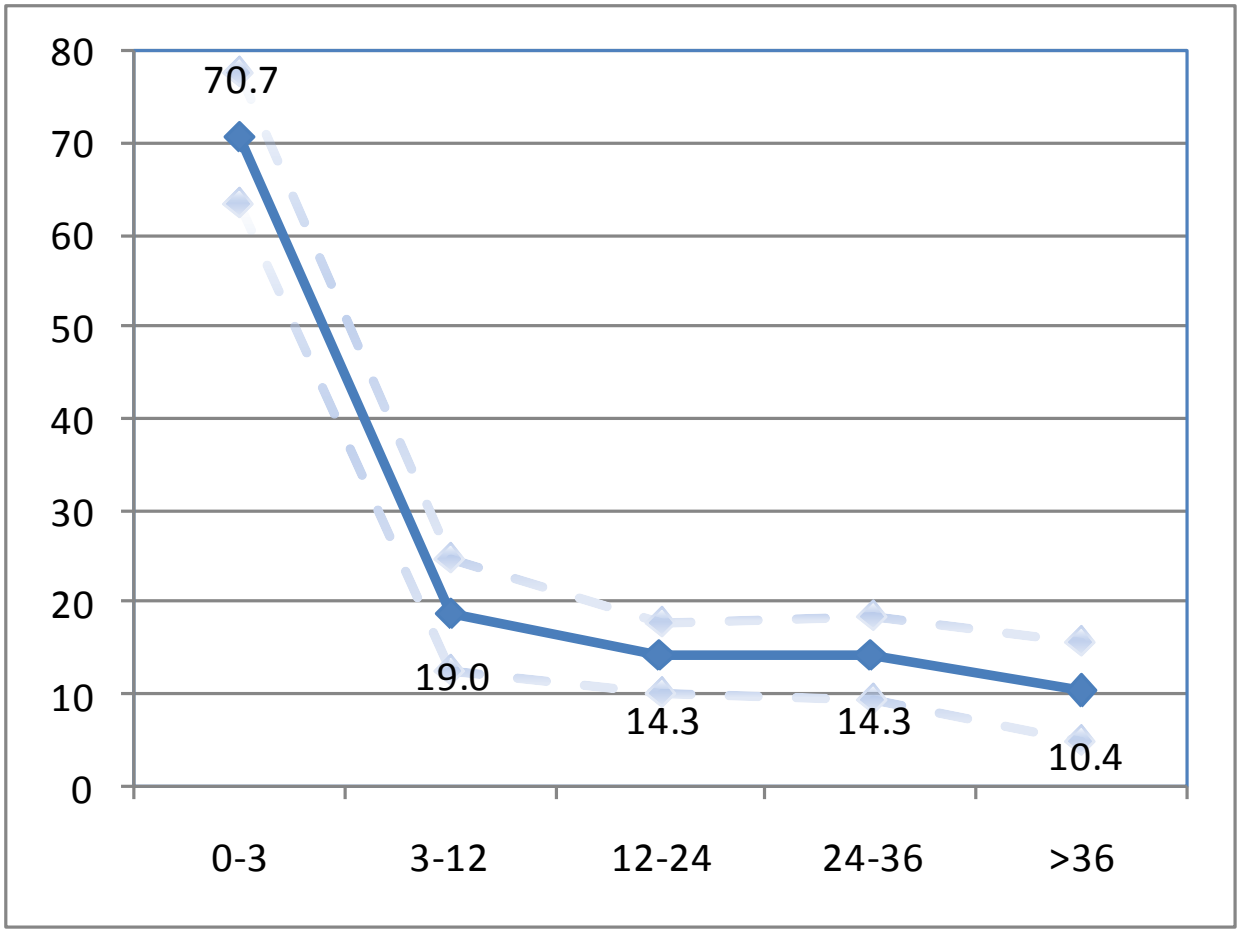
Figure 2a: Disability grant access (%), by treatment duration (months)



Note: Includes only those patients interviewed in all survey rounds in each study cohort in order to represent a true representation of the trend over treatment duration in disability grant access. Dotted lines represent 95% confidence intervals for the reported mean values. The reported differences are statistically significant at the 99.9% level ($F=18.4$, $p < 0.001$).

Source: Authors' own calculations.

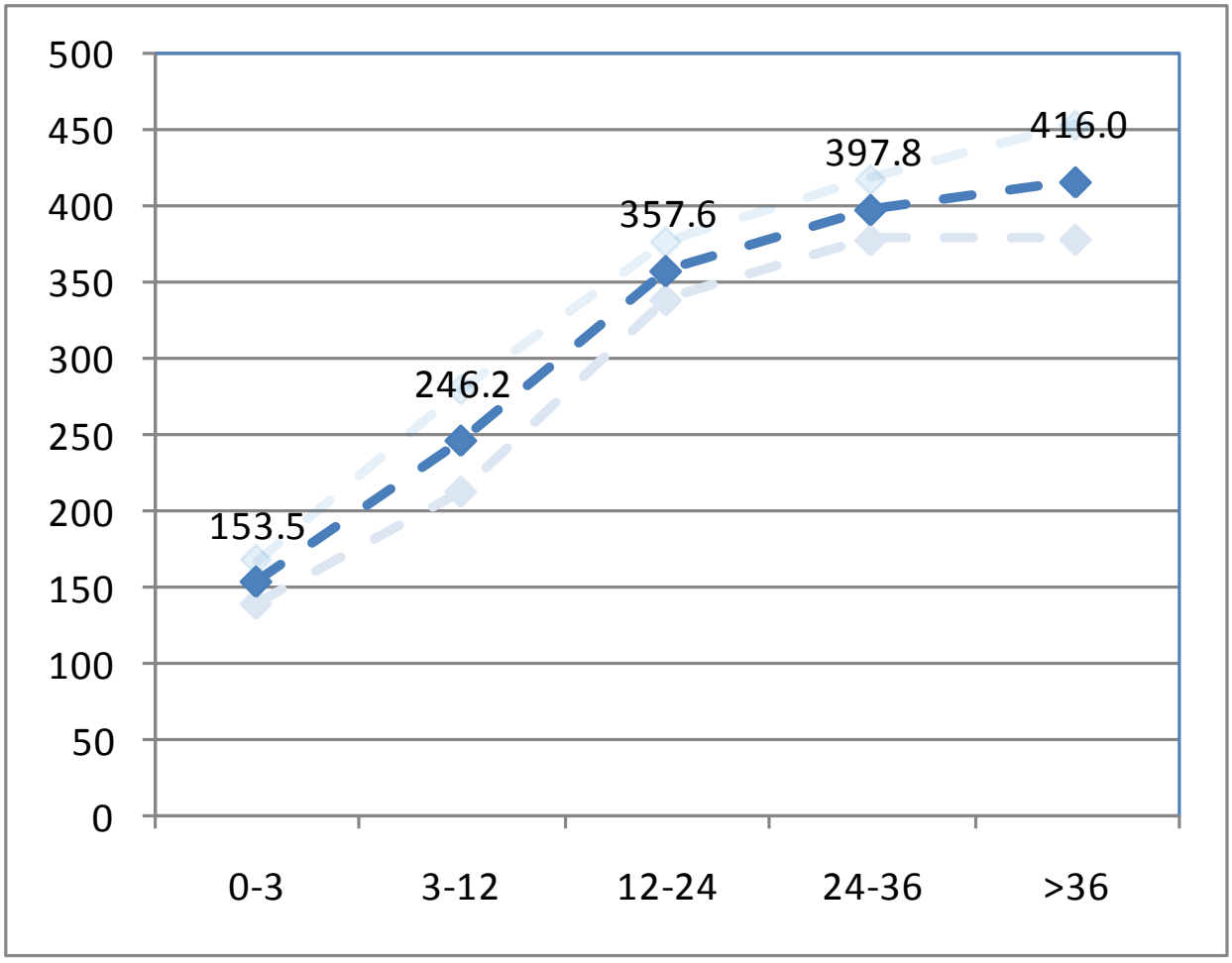
Figure 2b: Disability grant terminations (%), by treatment duration (months)



Note: Include transitions observed between consecutive interviews for all study participants, including replacements and study participants lost to follow-up, this to maximize statistical power. Dotted lines represent 95% confidence intervals for the reported mean values of the 0/1 binary variables. The reported differences are statistically significant at the 99.9% level ($F=76.54$, $p < 0.001$).

Source: Authors' own calculations.

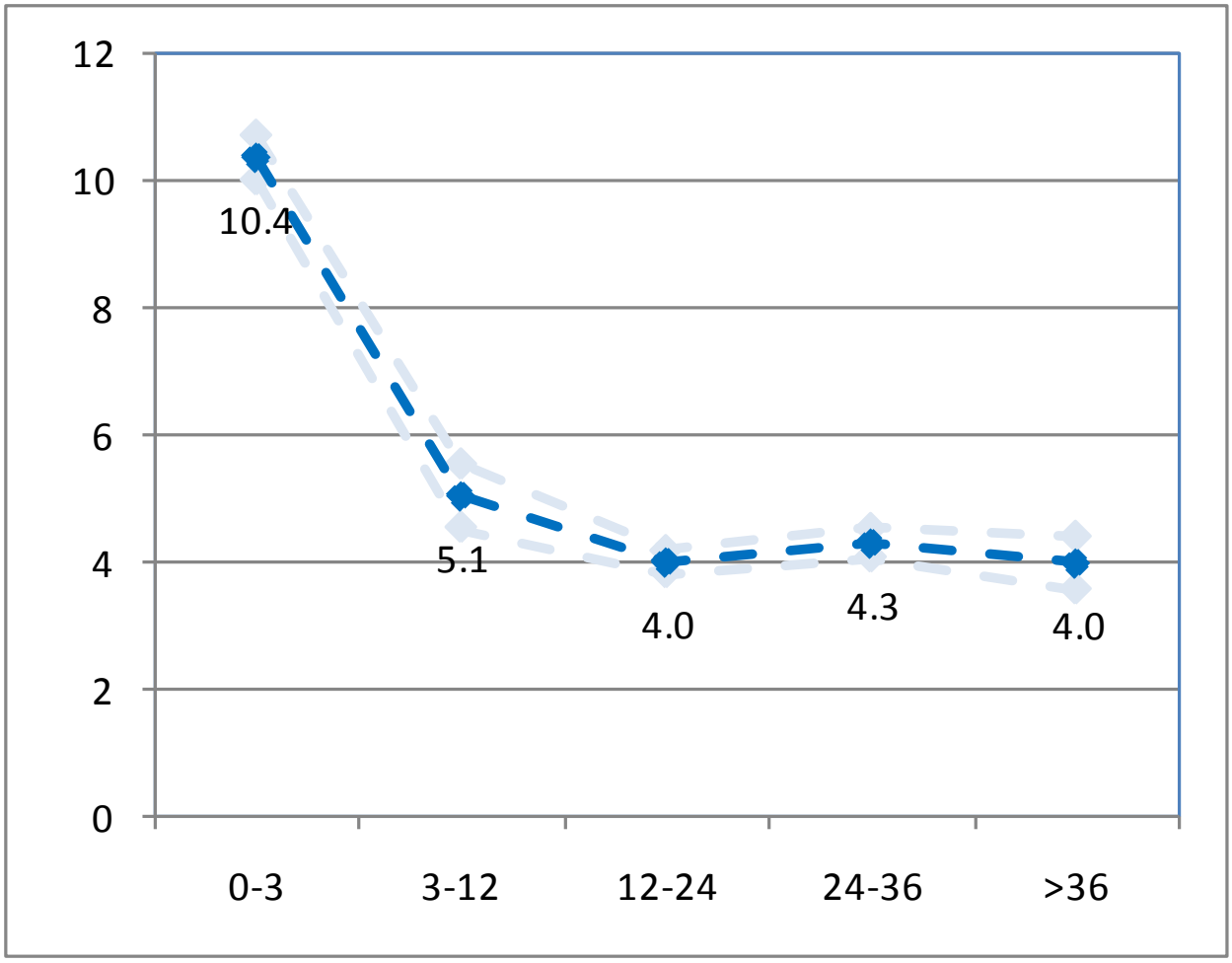
Figure 3a: CD4 count, by treatment duration (months)



Note: Includes only those patients interviewed in all survey rounds in each study cohort in order to represent a true representation of trends over treatment duration in the relevant outcome. The reported differences are statistically significant at the 99.9% level ($F=83.8$, $p < 0.001$).

Source: Authors' own calculations.

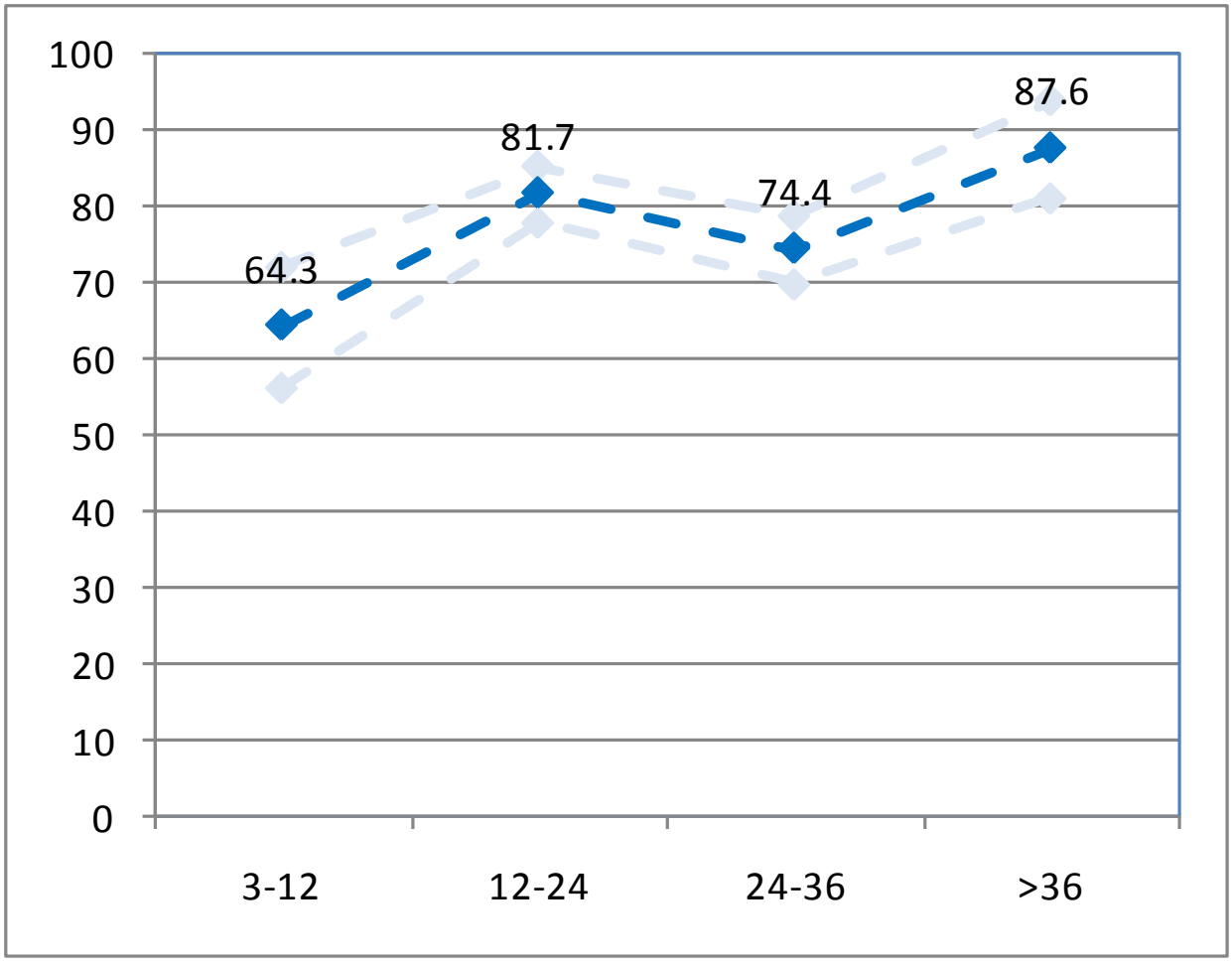
Figure 3b: Viral load (RNA), by treatment duration (months)



Note: Viral load is reported as natural logarithms. Analysis includes only those patients interviewed in all survey rounds in each study cohort in order to represent a true representation of trends over treatment duration in the relevant outcome. The reported differences are statistically significant at the 99.9% level ($F=335.01$, $p < 0.001$).

Source: Authors' own calculations.

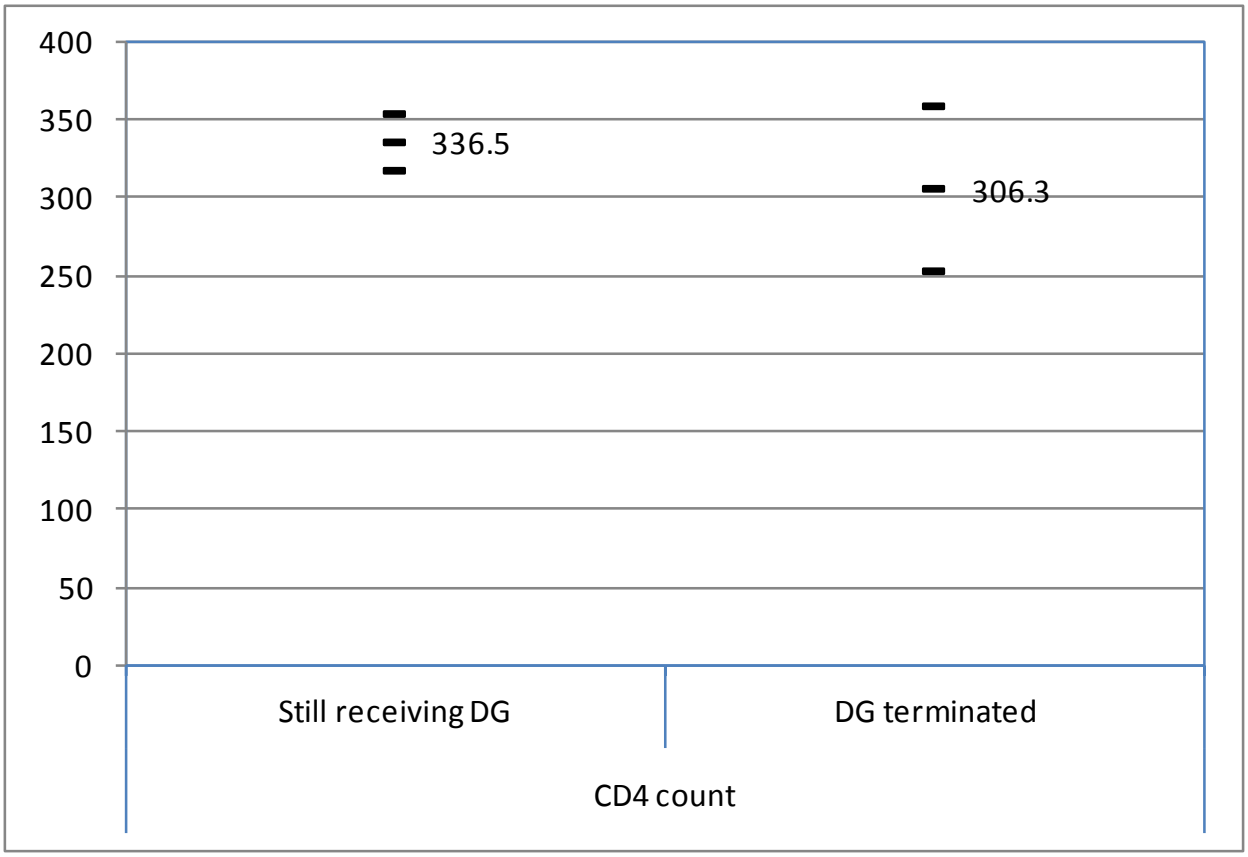
Figure 3c: Virologic suppression (%), by treatment duration (months)



Note: Includes only those patients interviewed in all survey rounds in each study cohort in order to represent a true representation of trends over treatment duration. The reported differences are statistically significant at the 99.9% level ($F=9.02$, $p < 0.001$).

Source: Authors' own calculations.

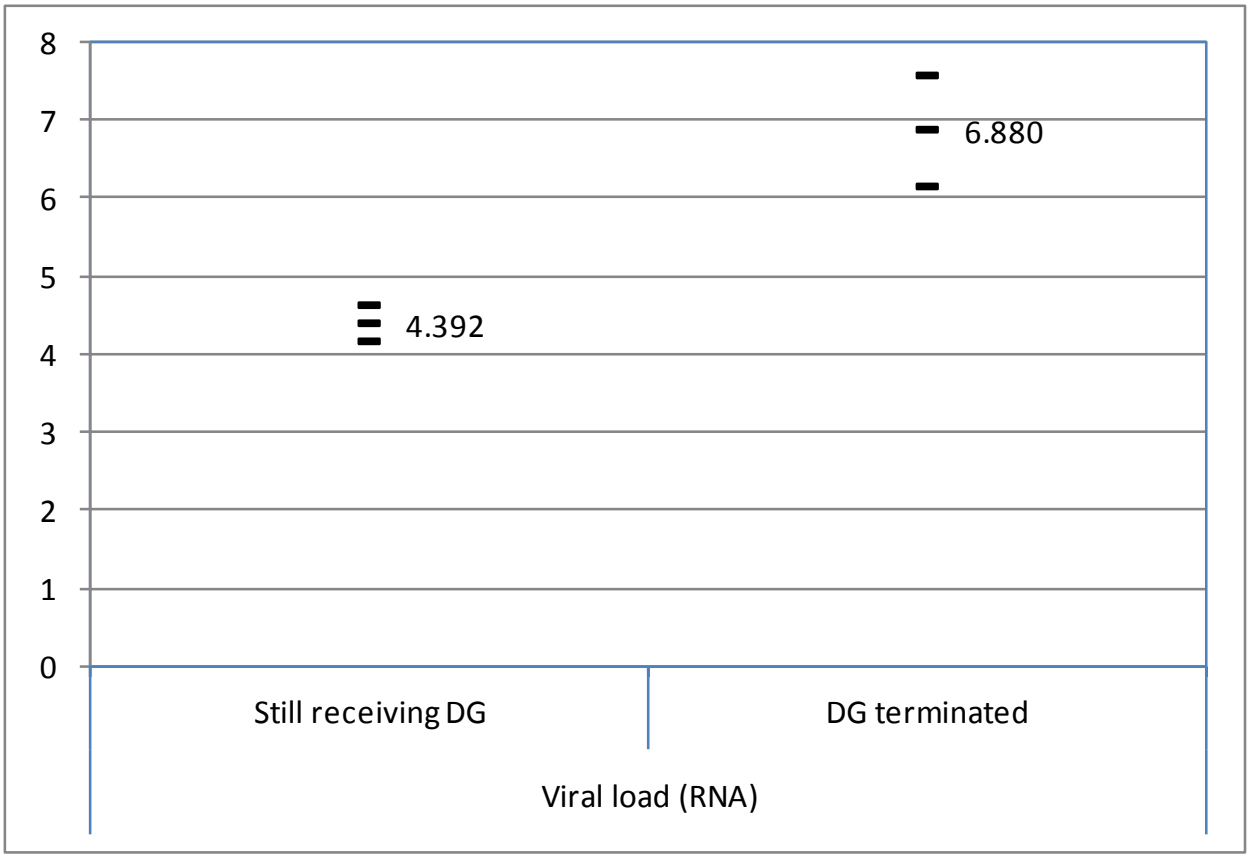
Figure 4a: CD4 count, by grant termination



Note: Include transitions observed between consecutive interviews for all study participants, including replacements and study participants lost to follow-up. Top and bottom lines represent 95% confidence intervals of the reported means. Differences are statistically significant at the 99.9% level ($F=76.54$, $p < 0.001$).

Source: Authors' own calculations.

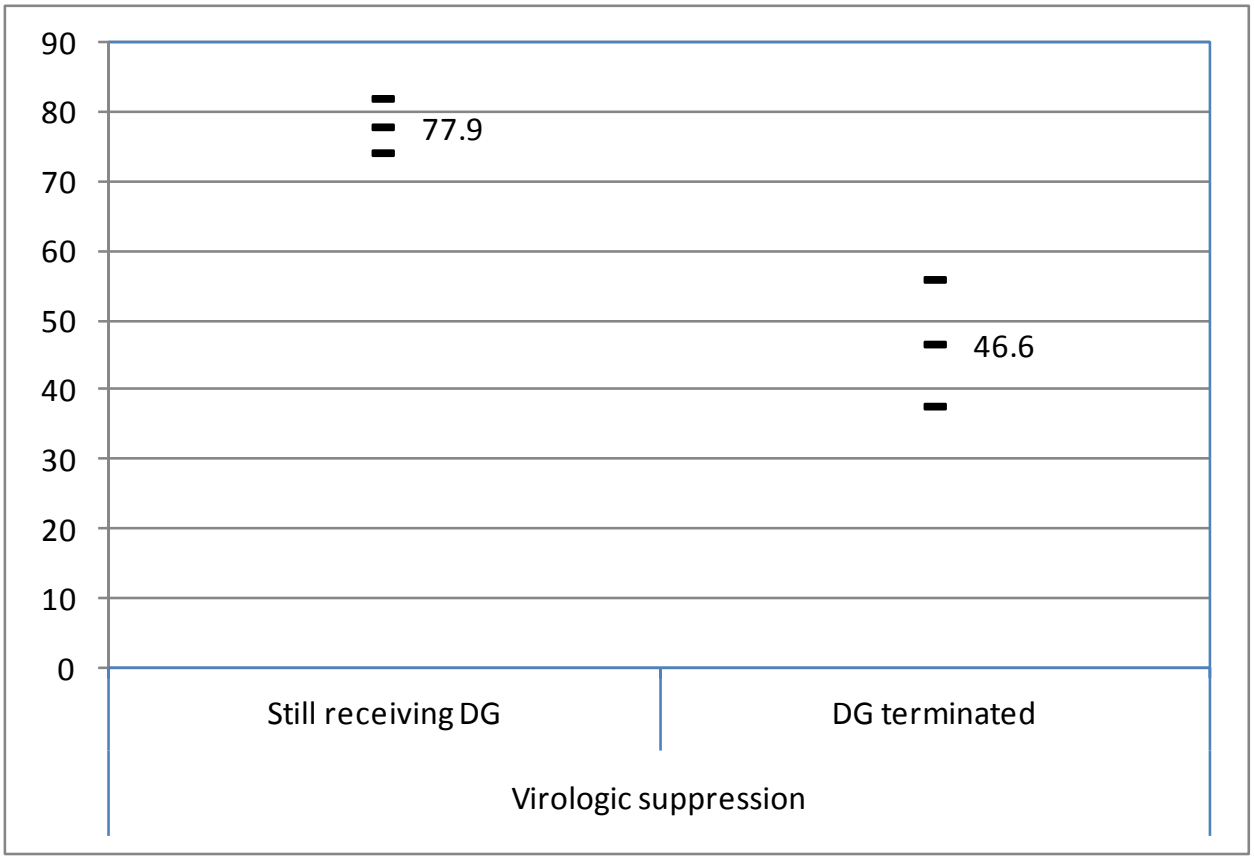
Figure 4b: Viral load, by grant termination



Note: Viral load is reported as natural logarithms. Include transitions observed between consecutive interviews for all study participants, including replacements and study participants lost to follow-up. Top and bottom lines represent 95% confidence intervals of the reported means. Differences are statistically significant at the 99.9% level ($F=76.54$, $p < 0.001$).

Source: Authors' own calculations.

Figure 4c: Virologic suppression (%), by grant termination



Note: Include transitions observed between consecutive interviews for all study participants, including replacements and study participants lost to follow-up. Top and bottom lines represent 95% confidence intervals of the reported means. Only differences in virologic suppression are statistically significant at the 99.9% level ($F=76.54$, $p < 0.001$).

Source: Authors' own calculations.

Table 2: Impact of disability grant terminations on virologic and immunologic responses to ARV treatment

	CD4 count			Viral load (RNA)			Viral suppression (0/1)		
	β	**95% CI**	**p-value**	**β**	**95% CI**	**p-value**	**β**	**95% CI**	**p-value**
A. Disability grant termination (0/1)	12.1	[-68.9 - 93.218]	0.769	0.729	[-0.198 – 1.658]	0.123	0.253	[0.087 - 0.733]	0.011
Sample size (n - N)		272 (494)			252 (453)			252 (453)	
R^2: within		0.109			0.011			n/a	
: between		0.415			0.455			n/a	
: overall		0.315			0.372			n/a	
Wald chi2 test (p-value)		208.3 (<0.001)			168.1 (<0.001)			44.8 (0.001)	
LR test (p-value)		37.7 (<0.001)			37.1 (<0.001)			22.3 (<0.001)	
B. Disability grant termination at ≤ 3 months on ART	-103.8	[-164.6- -43.0]	0.001	4.078	[2.588 – 5.567]	<0.001	0.019	[0.002 - 0.181]	0.001
Sample size (N)		272 (494)			252 (453)			252 (453)	
R^2: within		0.018			0.106			n/a	
: between		0.406			0.509			n/a	
: overall		0.280			0.418			n/a	
Wald chi2 test (p-value)		271.2 (<0.001)			301.7 (<0.001)			35.6 (0.059)	
LR test (p-value)		32.5 (<0.001)			46.8 (<0.001)			25.5 (<0.001)	

Note: Viral load is reported in natural logarithms. Results are for linear [viral load and CD4 count] and logistic [viral suppression] Random Effects (RE) panel regression models. Coefficients for viral suppression regression models are reported as odd ratios (OR). All regression models are statistical significant in terms of over-all fit, as reflected in the LR or Wald chi2 statistics ($p<0.10$). The Breusch and Pagan Lagrangian multiplier test statistic [linear regression models] and LR test statistic [logistic regression models] show that the RE estimator in each case outperform the pooled estimator ($p<0.001$).

Source: Authors' own calculations.