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Conceptual Framework for Investigating and Influencing Adherence Behavior among HIV-Positive Populations: An Applied Social Cognition Model

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Abstract

Non-adherence remains a significant barrier to achieving successful HIV treatment outcomes. This review aimed to holistically examine the concept of adherence in the light of current research evidence and to provide a basic and adaptable conceptual framework for investigating and influencing adherence behavior among various HIV populations. We reviewed published journal articles and gray literature within the period from 2000 to 2017. A comprehensive search from major online databases and repositories such as PubMed, Scopus, Medline, Google Scholar, and Cochrane Database of Systematic Reviews was conducted using focused search terms that included "social cognition models" or "theories and models of health behavior change" or "behavior change in health psychology" or "theory-based interventions" or "behavioral frameworks" and "adherence behavior" or "medication adherence," and "HIV patients" or "HIV/AIDS." Only papers published in English were included in this study. We found varied and extensive literature evidence supporting the use of psychobehavioral models to promote conceptual understanding of adherence behavior among HIV-positive patients globally. We observed that certain approaches at investigating non-adherence worked better among certain populations and epidemics than others, largely because of contextual differences in barriers and burden of non-adherence among these populations. We synthesized the evidence and applied social cognition models in explaining and providing a basic, evidence-based and adaptable conceptual framework for investigating and influencing adherence behavior among HIV-positive populations around the world, regardless of geographical and HIV epidemiological context. **(AIDS Rev. 2019;21:157-169)**

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Key words

Adherence. Behavior. HIV/AIDS. Conceptual framework. Social cognition model.

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Introduction

The advent of antiretroviral (ARV) therapy (ART) and the continual global efforts to improve its availability to HIV-positive patients who require treatment has transformed HIV from an acutely fatal condition to a more chronic and manageable condition[1] like hypertension, diabetes, and rheumatoid arthritis for which treatment success is hugely dependent on adherence to medications and other components of therapeutic care[2]. By consensus, several researches and programmatic experiences have established that treatment adherence is arguably the single, most important issue in successfully managing HIV/AIDS; thus, a high level of sustained adherence (> 95%) is necessary to achieve viral suppression and improve immunological and clinical outcomes[3].

Despite significant progress toward the 90-90-90 global target with over 20 million HIV-positive patients currently receiving ART worldwide[4], non-adherence to treatment remains a stumbling block capable of not only reversing the gains so far achieved with epidemic control in many parts of the world but also creating a huge burden of HIV resistance to currently available ARV medications. Barriers to optimal adherence have been extensively researched and documented in literature[5].

By definition, adherence – like other health behaviors – encompasses all overt behavioral patterns, actions, and habits that relate to health maintenance, health restoration, and health improvement[6]. Factors that predict health behavior include those extrinsic to the individual such as incentives structure (e.g., taxing tobacco and alcohol) and legal restrictions (e.g., fining individuals for not wearing seat belts or banning dangerous substances). On the other hand, intrinsic factors include demographic factors (such as age, gender, socioeconomic, and ethnic status), social factors (such as learning, reinforcement, modeling, and social norms), genetics (e.g., possible genetic basis for alcohol abuse), and socio-economic/environmental factors (such as income and access). Other intrinsic factors include emotional factors (such as anxiety, stress, tension, and fear), personality factors (such as sensation seeking), and cognitive factors (such as knowledge, beliefs, and attitudes of both the patient and healthcare professionals)[7].

In general, studying health behavior and intervening to address behavioral challenges in health helps to reduce morbidity and mortality from diseases, reduce health-care costs; ensure greater individual responsibility for health, and impacts on the quality of life and well-being[8]. To this extent, it is imperative to provide a conceptual understanding of the multi-dimensional constructs underpinning adherence behavior to provide a focused basis for designing context-specific and individualized interventions that help to pre-empt, diagnose, intervene, and monitor adherence to HIV treatment as patients progress along the continuum of care.

Objectives

In this paper, we first review the concept of adherence behavior in the light of the theoretical frameworks and psychobehavioral models that have been broadly applied in exploring as well as investigating and influencing adherence behavior among different HIV populations around the world. We then synthesize current evidence and apply social cognition model to explain the multi-dimensional nature of adherence behavior among HIV-positive patients receiving ART. Finally, we apply one of the social cognition models to provide a basic, evidence-based, and adaptable conceptual framework (based on targeted manipulation of the five main domains of factors that influence treatment adherence and outcomes) for investigating and influencing adherence behavior among HIV-positive populations around the world, regardless of geographical, and HIV epidemiological context.

Search strategy

This was a comprehensive review of literature on HIV treatment adherence covering both published research and gray literature within the period from 2000 to 2017. We conducted a comprehensive search of major online databases and repositories such as PubMed, Medline, Google Scholar, and Cochrane Database of Systematic Reviews with a combination of focused search terms including “social cognition models” or “theories and models of health behavior change” or “behavior change in health psychology” or “theory-based interventions” or “behavioral frameworks” and “adherence behavior” or “medication adherence,” and “HIV patients” or “HIV/AIDS.” We approached the review from a broad perspective and sought to identify the theoretical frameworks underpinning the studies and recommendations in this area of research. Only articles published in English were included in the study.

Conceptual understanding of adherence

Like other aspects of human behavior, health behaviors are believed to be multi-dimensional constructs with emotional, physical, social, and psychological determinants that influence intentions and behavior in specific ways. Theoretical understanding of these determinants and how to target them for intended behavior change has been the focus of many theory-based intervention programs in the past few decades.

Theories underpinning adherence behavior – Social cognition models

Social cognition models are the basis for health behavioral interventions and have been widely used to examine the predictors of health behaviors using individual's cognitions to understand the determinants of current intentions and behavior, predict future health intentions and behavior, and predict which health determinants should be targeted to change behavior[9]. Notwithstanding a few specifics, these models generally suggest that human functioning can be explained by the triadic interactions of behavior, personal, and environmental factors, in what is often known as reciprocal determinism[10].

In general, there are three types of social cognition models, namely:

1. Motivational models (e.g., The Health Belief Model [HBM], the Protection Motivation Theory [PMT], and Theory of Planned Behavior [TPB]) – These models focus on the motivational factors that support individuals' decisions to perform (or not to perform) health behaviors. They simply imply that motivation is sufficient for successful behavioral enaction.

These models generally seek to promote individual's responsibility for their health and therefore encourage action/decision to perform a health behavior on the basis of individual risk perception, perception of severity as well as benefits of avoidance of the condition, and finally, the self-efficacy to change their behavior accordingly.

The HBM, like the PMT, has been extensively and successfully applied in HIV prevention and testing studies/interventions[11-16], with cues to actions at each stage of the change model believed to be vital in the change process and easily measurable through knowledge, attitude, and self-reported behavioral surveys. The main drawback of this model remains its lack of reference to the sociocultural, environmental, and interactive context in which individuals come to judge their susceptibility to risks[17] (Figs. 1 and 2)[18,19].

Because the TPB acknowledges and accounts for subjective norm (perceived social pressure to perform a particular behavior) as a predictor of behavioral intention in addition to perceived behavioral control and attitude, it has been shown to be a more reliable predictor of intentions and behavior across a wide range of health behaviors including HIV testing and preventive behaviors[20-25].

2. Behavioral enaction models (e.g., Gollwitzer's Implementation Intentions) – These models focus on bridging the "gap" between motivation and behavior in a post-intentional manner (motivation not sufficient for action) (Fig. 3)[26].

Basically, these models support individuals to reduce the gap between intention and behavior – through formation of strong implementation intentions – by achieving a strong mental representation of the "if-then" plan thereby strategically automating goal striving by shifting from top-down to bottom-up information processing[27-29].

Whereas the implementation intention models have been successfully applied in achieving behavioral change in various areas of medical research including medication adherence in individuals with epilepsy[30] and stroke survivors[31], evidence of its successful application in HIV prevention, testing, and treatment is still emerging and has been the focus of many recent studies[32].

3. Multi-stage models (e.g., The Health Action Process Approach [HAPA] and Transtheoretical Model (TTM) of change) – These models are based on the knowledge that individuals at different stages behave in different ways and therefore interventions should be stage-managed (Figs. 4 and 5)[33,34].

These models generally describe a self-regulation framework with distinctive phases/stages and determinants of behavior as well as related processes and construct underpinning the linkage between the conscious determination/intention to perform a particular health action/behavior and the eventual performance and maintenance of such behavior/action[33]. Like HAPA, a recent systematic review conducted by Hashemzadeh et al.[35] reported that TTM has been effectively applied in behavioral change management and prevention of chronic disease[36,37] including HIV[38] and risk factor modification[39,40].

Each of these models has cross-cutting and sometimes specific assumptions, components, variables and strengths, and limitations. Given the complexity of human behavior and the dynamism of factors that influence health behavior, many researchers have now adopted approaches that favor integration of more than

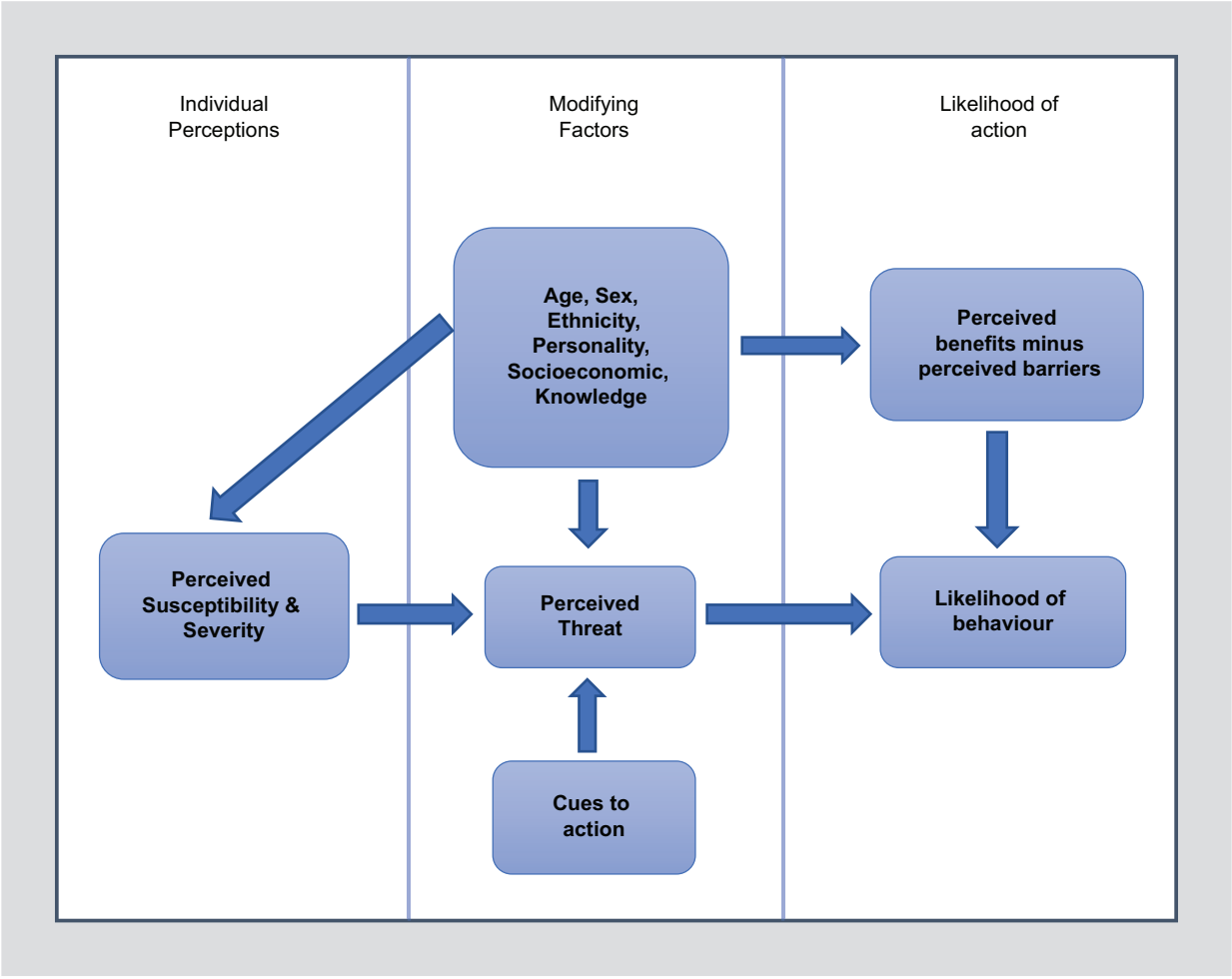

Figure 1. *The Health Belief Model (adapted from Glanz et al., 2002)*[18].

one theoretical model in investigating and influencing health behaviors.

Applied TPB to the understanding of adherence behavior

Several constructs underlie the process of human learning and behavior change and variables such as self-efficacy, outcome expectations, intention or motivation, self-control, reinforcements, emotional coping and observational learning, perceived susceptibility or vulnerability may also intervene in the process of behavior change. Adherence is a concept with social and emotional components; therefore, a therapeutic alliance between the provider and the patient is required to stimulate positive behavioral change and optimize adherence to ART.

Because of its strengths and evidence of wide applicability in the field of health behavior research, the TPB as described by Ajzen[41] has gained international acceptability and recognition in its ability to enable researchers understand in detail the determinants of current intentions and behavior, predict future health intentions and behavior and predict which health determinants should be targeted to change behavior[6]. In particular, the theory has been explained and successfully applied in the context of behavior change in HIV/AIDS patients[42], including behavioral intentions to initiate and sustain ART[43].

According to the TPB[44], human action is guided by three kinds of considerations:

a. Beliefs about the likely outcomes of the behavior and the evaluations of these outcomes (behavioral beliefs),
b. Beliefs about the normative expectations of others and motivation to comply with these expectations (normative beliefs), and
c. Beliefs about the presence of factors (both inter-

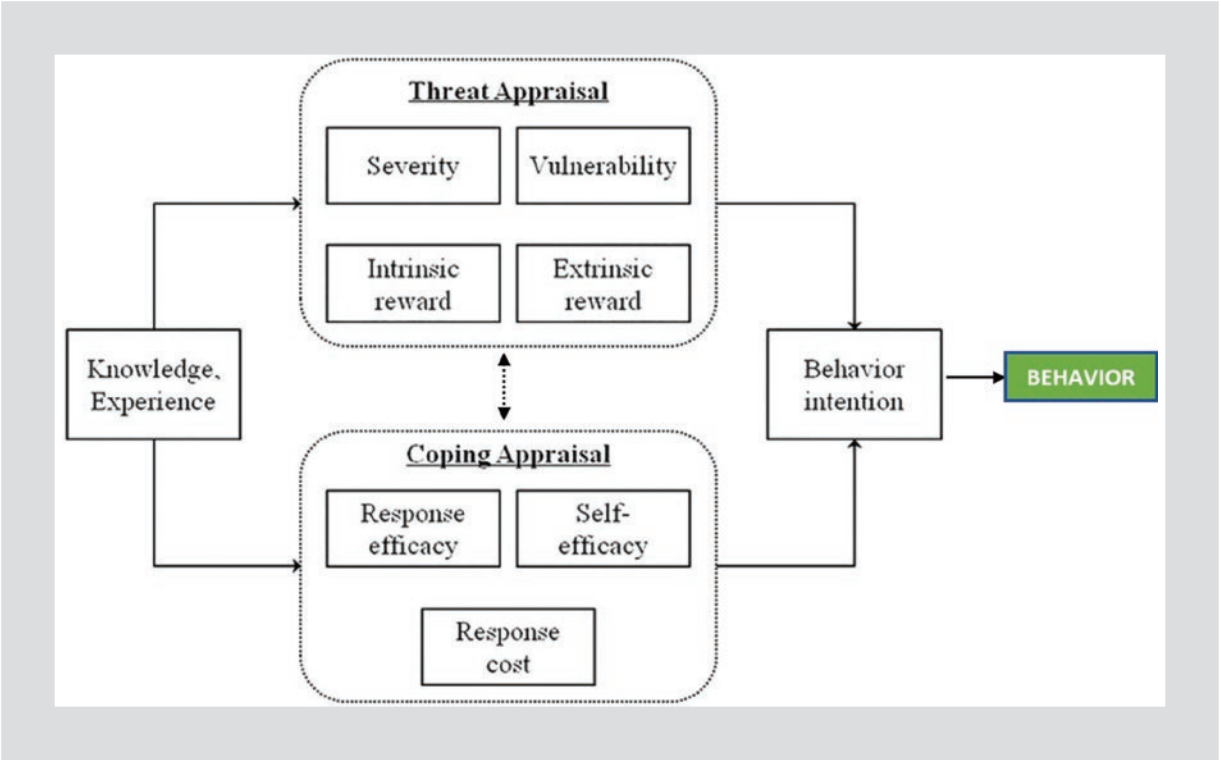

Figure 2. *Protection Motivation Theory (adapted from Xiao et al., 2014)[19].*

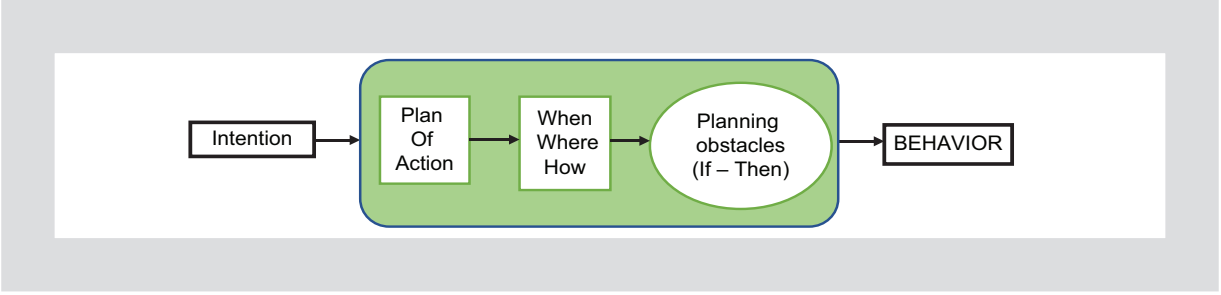

Figure 3. *Implementation Intentions (The "If-Then") (adapted from Simpriano et al., 2015)[26].*

nal and external) that may facilitate or impede performance of the behavior and the perceived power of these factors (control beliefs).

In their respective aggregates, behavioral beliefs produce a favorable or unfavorable attitude toward the behavior; normative beliefs result in perceived social pressure or subjective norm, and control beliefs give rise to perceived behavioral control.

In combination, attitude toward the behavior, subjective norm, and perception of behavioral control lead to the formation of a behavioral intention. As a rule, the more favorable the attitude and subjective norm, and the greater the perceived control, the stronger should be the person's intention to perform the behavior in question. Finally, given sufficient degree of actual control over the behavior, people are expected to carry out their intentions when the opportunity arises.

The intention is thus assumed to be the immediate antecedent of behavior. However, because many behaviors pose difficulties of execution that may limit volitional control, it is useful to consider perceived behavioral control in addition to intention. To the extent that perceived behavioral control is veridical, it can serve as a proxy for actual control and contribute to the prediction of the behavior in question. Figure 6 below is a schematic representation of the theory.

This concept has been successfully applied to a range of health behaviors such as drug use, condom

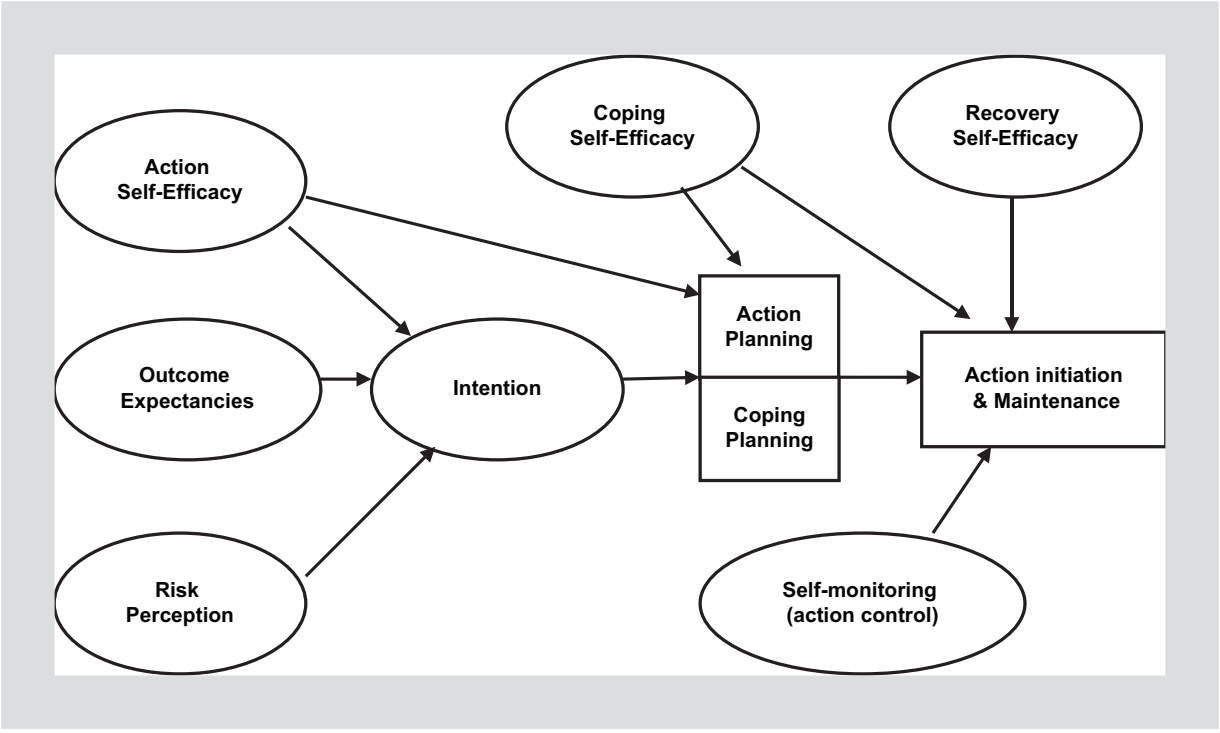

Figure 4. *Health Action Process Approach (reproduced with permission from Schwarzer, 2016)*[33].

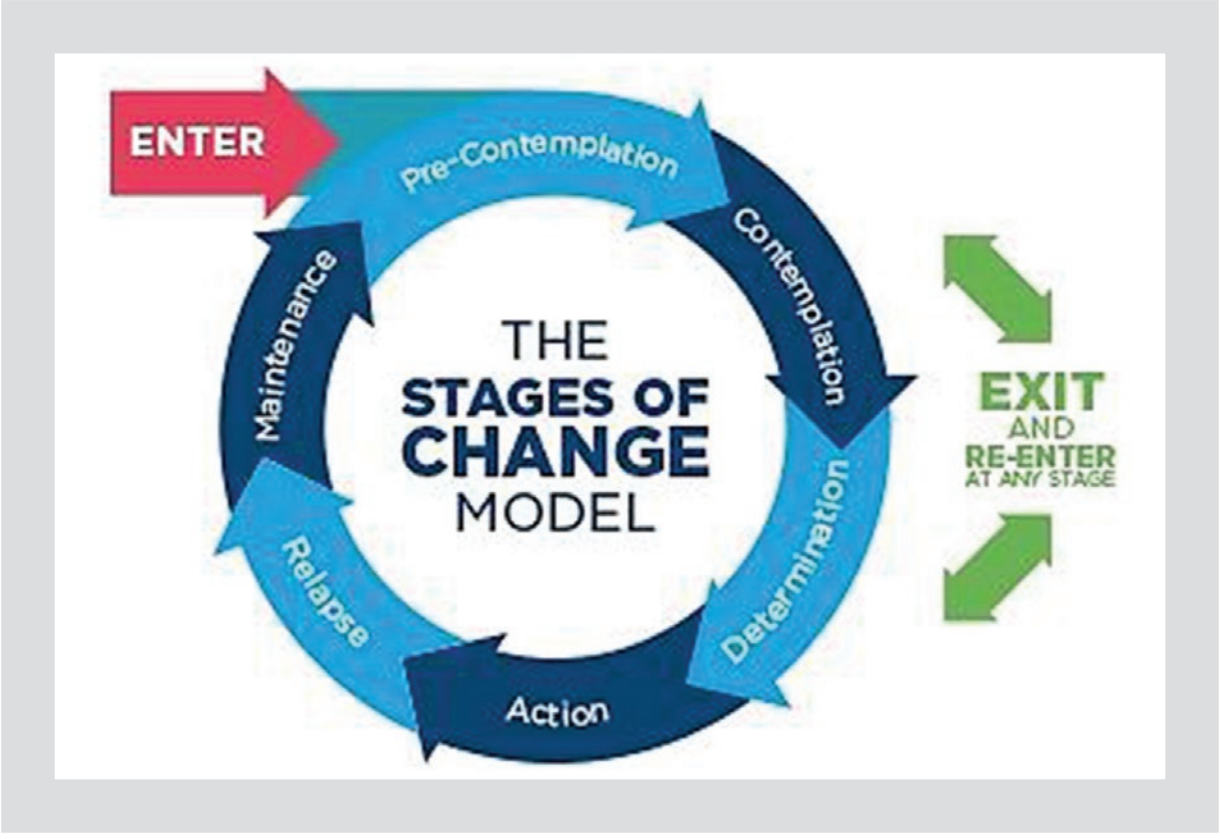

Figure 5. *Transtheoretical Model of Change (adapted from Prochaska and Velicer, 2000)*[34].

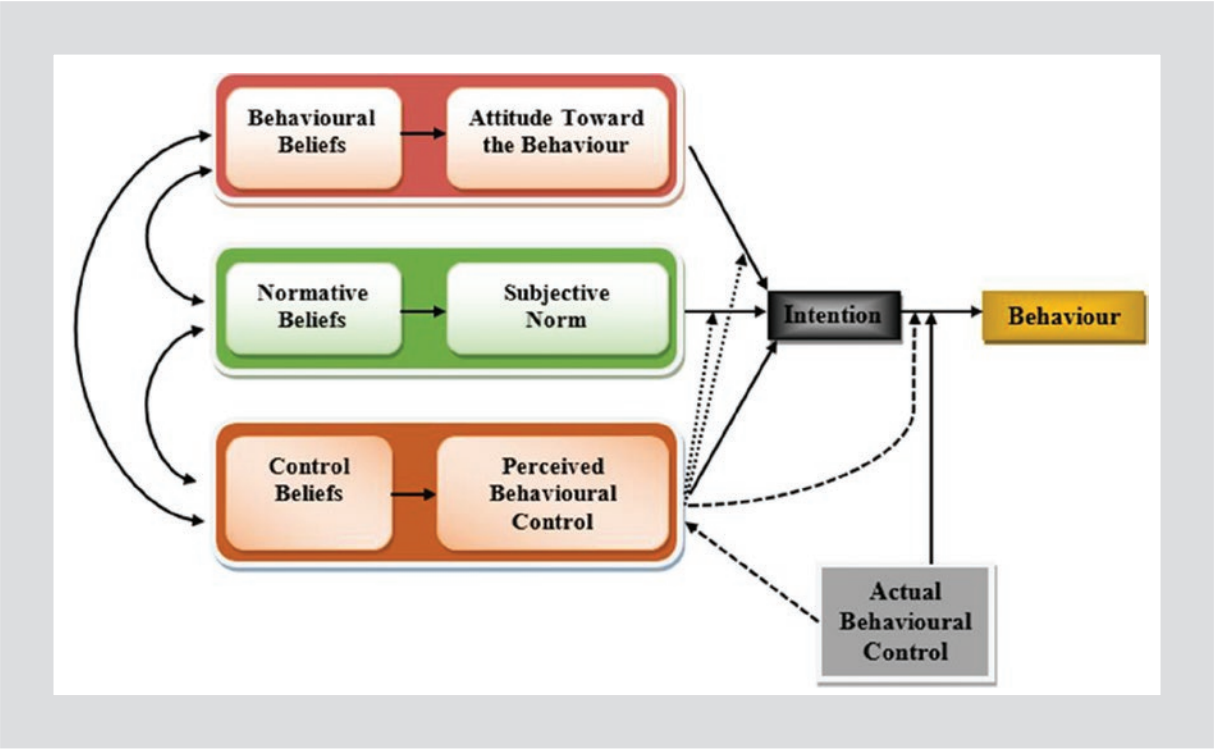

Figure 6. *Ajzen's Theory of Planned Behavior (adapted from Azjen, 2006 and 2019)*[45].

use, dietary behavior, alcohol consumption, health screening attendance, and exercise. In the context of treatment adherence, adherence behavior can be explained, as shown in Figure 7.

Interventions to improve adherence

Research and programmatic experiences have shown that no single intervention or package of interventions has cross-cutting effectiveness in dealing with adherence problems within and between populations. Because people's need and circumstances may change over time, a multi-faceted approach involving a combination of several feasible packages to optimize adherence to ART is most likely to be beneficial. It is the responsibility of program managers and clinicians/health-care providers to determine and implement appropriate program-level and individual-level interventions to improve adherence. In particular, a combination of interventions including the active involvement of patients in their treatment decision-making processes, provision of appropriate supports, and multidimensional educational/reminder programs that teach behavioral skills to the patient to enhance their adherence, and tailoring of the regimen to fit the patient, have potentials to yield the best results.

In general, interventions to improve adherence can be divided into program-level interventions and individual-level interventions. Program-level interventions for improving adherence to ART include:

1. Avoiding imposing out-of-pocket expenses/payments at the point of care
2. Using fixed-dose combination regimens for ART
3. Strengthening drug supply management systems to reliably forecast, procure, and deliver ARV drugs, and prevent stock-outs.

Machtinger & Bangsberg (2005)[46] further classified interventions to improve adherence into five major categories, namely:

1. Patient education and collaborative planning
2. Adherence case management
3. Directly observed therapy
4. Simplified treatment regimens, and
5. Adherence devices – Including medication organizers (pillboxes), reminder devices/strategies, and visual medication schedules.

Literature evidence showed that several studies to improve adherence have focused on re-enforcing patient's commitment and intention to adhere to their medications as a means to stimulate good adherence behavior through individual-level interventions that often include psychosocial/behavioral interventions such as patient education and counseling, use of reminder devices in-

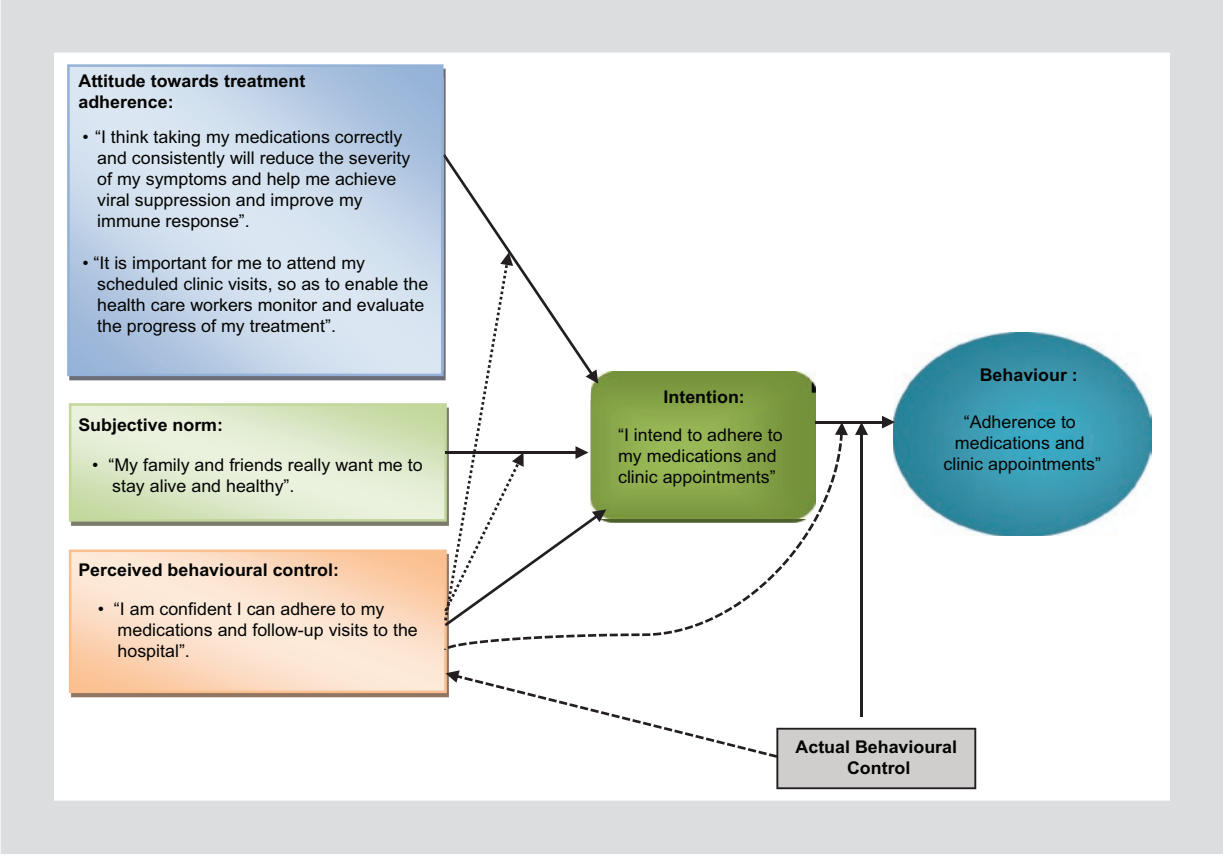

Figure 7. *Adherence behavioral control model (adapted from Azjen, 2006 and 2019)*[45].

cluding text messages, adherence case management, and directly observed therapy either as single interventions or in combination[46]. Evidence from these studies has proven their relative effectiveness in improving adherence behavior[47-52]. In addition, it has been established from previous studies that fixed-dose multidrug single-tablet regimen (STR) and simplified (once-daily) regimen, including single-dose multi-tablet regimen (single-dose MTR) significantly improve adherence to ART[53-56]. It is, therefore, unsurprising that treatment programs worldwide are gradually drifting toward a package of adherence interventions that include the use of once-daily STR alongside other program and individual-level interventions itemized above, in line with current WHO recommendations.

A recent meta-analysis that compared adherence and viral suppression across all settings (global network) and in low-middle income countries network identified 10 core interventions in monitoring medication taking[57]. These include:

- Standard of Care (SOC) – Instructions are given by the healthcare provider at treatment initiation on how to take ART medication and the importance of adhering to it
- Enhanced SOC – These include interventions which provide additional support than usual care, such as adherence counseling, education sessions, and motivations
- Telephone – In this approach, interventions use scripted serial telephone calls or calls to support patients. The frequency of calls will vary between 2 weeks and 2 months with regular intervals, but in certain circumstances, the calls may be as frequent as weekly or daily (Table 1)[58].
- Short text messaging service – Text messages are sent to patients' mobile phones which include one-way or two-way, long or short messages, at different periods of time (Table 2).
- Behavioral Skills Training or Medication Adherence Training – These include interventions that provide educational training on how to adhere to ART; it involves modular-based learning to improve life-skills, behaviors, and knowledge (Table 3)[59].
- Multimedia – Interventions that use resources online.
- Cognitive Behavioral Therapy (CBT) – This strategy includes CBT and cognitive-behavioral stress management, as well as interventions that involved counseling by patients initiated on ARTs

Table 1. The effect of phone calls to promote ART adherence

Phone call interventions were hypothesized to improve adherence rates among patients receiving ARTs. A randomized controlled trial was conducted to investigate the effects of phone call intervention on adherence to ART and quality of life (QOL) of treatment-naive and treatment-experienced patients in Baoshan, China[58].

Intervention
103 treatment-naive and 93 treatment-experienced HIV/AIDS patients were consecutively recruited. The main outcome measures (adherence and QOL) were measured using self-reported questionnaires at day 15, 1, 2, and 3 months after the start of treatment for treatment-naive patients and post-3 months after subject enrollment of treatment-experienced patients.

Outcome
Phone call intervention was postulated to result in a high level of adherence rates in both treatment-naive and treatment-experienced patients. At post-3months, significant QOL improvements were observed in domains of physical health, level of independence, environment, and spirituality/religion/personal beliefs among treatment naïve patients. It could be concluded that a mobile phone intervention in HIV-infected patients resulted in high levels of adherence and improvements in certain dimensions of QOL

Table 2. SMS reminders to promote ART adherence

SMS interventions were thought to be suitable for low-middle income countries (LMICs) due to its ability to reach substantial numbers of HIV-infected patients at a minimal cost[56]. Given its assumption, a recent single-blinded, parallel-group RCT was conducted to evaluate the effectiveness of mobile phone reminders (SMS texts and phone calls) and peer counseling on adherence rates and treatment outcomes among HIV-infected patients in Malaysia[47].

Intervention
The trial involved 242 consenting adult HIV-infected Malaysian subjects who were randomized into intervention or control groups (121 subjects each arm), respectively. In addition to counseling interventions at every clinic visits, the intervention group received a reminder module delivered through SMS and telephone call reminders for 24 consecutive weeks. Data on adherence behavior were evaluated using the specialized, pre-validated Adult AIDS Clinical Trial Group (AACTG) adherence questionnaires.

Outcome
With attrition of 7% post-6 months, the adherence rate for the intervention group was significantly higher compared to the control group. This trial highlighted a significantly lower frequency of missed appointments, lower viral load, and higher rise in CD4 counts at post-6 months in the intervention group. It was concluded that mobile phone interventions (SMS and telephone call reminders) significantly improved treatment adherence and outcomes in HIV-infected patients.

Table 3. The integrated behavioral intervention

In 2011, researchers from the University of Connecticut conducted a randomized clinical trial to test an integrated behavioral model that may enhance HIV treatment adherence and to reduce HIV transmission[59].

Intervention
HIV/AIDS infected individuals (310 men and 126 women) were recruited in the trial (217 in the integrated intervention arm and 219 in the controlled arm). Both arms delivered a 45-min one-on-one orientation and goal-setting session with one of the group facilitators before five 120-min group sessions (first group session applied team-building game on the basics of HIV; second group session applied decisional balance exercises on HIV treatment; third group session focused on sexual decision-making under various nuanced conditions; fourth group session applied core activities for subjects with the aim to build treatment and safer sex decision skills such as to wear vision-disorienting goggles to simulate intoxication while filling pillboxes with mints and to apply condom to a penis model; and fifth group session offered skills-building activities to improve treatment adherence and recognizing symptoms of sexually transmitted infections [STIs]) and a 60-min post-group one-on-one counseling session. The investigators used unannounced pill counts to monitor ART adherence and computerized interviews to measure risk behaviors.

Outcome
The trial found that the integrated transmission risk reduction intervention showed higher ART adherence and less unprotected intercourse with non-seroconcordant partners at 3- and 6- month follow-ups as well as fewer new STIs diagnosed over the 9-month follow-up period. The trial concluded that a theory-based integrated behavioral intervention improves ART treatment adherence and reduce transmission risks.

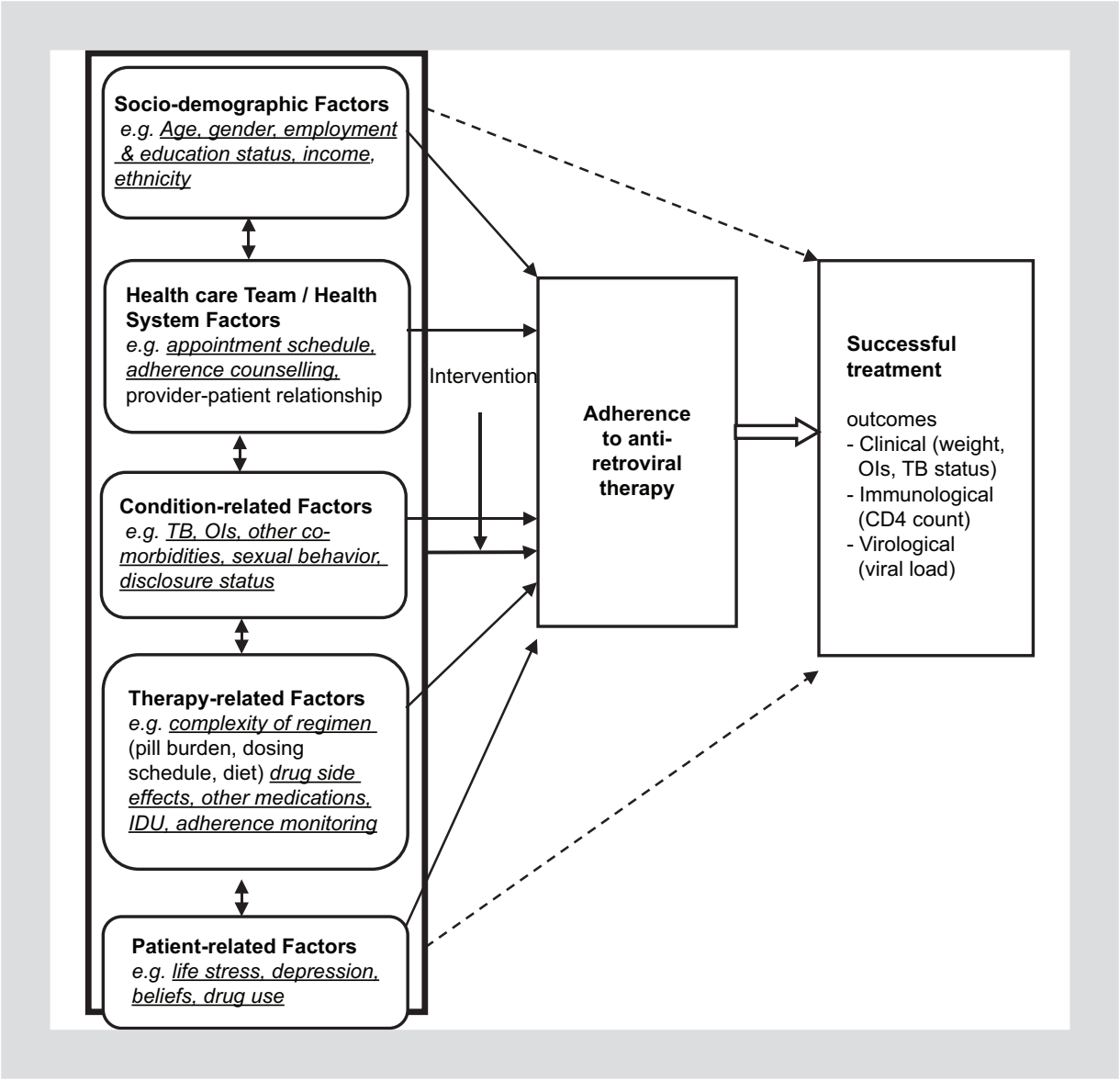

Figure 8. *A conceptual framework for investigating and influencing adherence behavior among HIV positive patients receiving antiretroviral therapy.* **A:** *Factors associated with non-adherence;* **B:** *Primary outcome;* **C:** *Secondary outcomes. Underlined factors: those often targeted for intervention.*

and trained professionals. The strategy also employs the use of motivational interviewing.

- Supporter – Interventions include the use of an individual (chosen by clinics or patients) to support medication adherence strategies (e.g., peer-support, home visits, treatment assistants, medication managers, directly observed therapy, and modified directly observed therapy).
- Incentives – Provide conditional or unconditional cash transfers, financial incentives, or giving vouchers to those adherent to the agreed treatment plan.
- Device Reminder – The use of calendars, alarms, pagers, or system devices to monitor diseases and treatments.

Evidence regarding the foregoing interventions suggests that they improve long-term adherence to ART therapy and are therefore beneficial in optimizing clinical and public health outcomes. However, these interventions varied in intensity and approach and have in some cases yielded heterogeneous outcomes among different populations and in different epidemiological contexts (concentrated vs. generalized epidemics), making global policy rec-

ommendations in a manner of "one size fits all" very challenging.

A conceptual framework for investigating and influencing adherence behavior

Given that the most important determinants of adherence behavior (all things being equal) have been established to be patient-related factors[60], it has become imperative for interventions to focus on (or at least include aspects) addressing psychosocial/behavioral determinants of non-adherence to achieve optimal clinical and public health outcomes. We propose below a conceptual framework for investigating and influencing adherence behavior, which has been proven to be beneficial in yielding positive behavioral change toward treatment adherence among HIV-positive patients[47]. This framework focuses on multifaceted approach to improve adherence based on a recipe of strategies that promote patient-centered health-care decision-making, provide efficient and sustainable support, offer an array of targeted reminder/educational programs to enhance patients' adherence behavior, and tailored regimen to fit the patient[61].

According to the WHO (2003), provider-patient relationship, health-care system factors, a host of patient factors and regimen characteristics are four major predictors of adherence behavior[62]. In addition to these, the socioeconomic status of patients is an important determinant of treatment adherence[7] and clinical outcomes. Figure 8 shows the conceptual framework (based on above predictors and Ajzen's Theory of Planned Behavior) that can be adapted for investigating and influencing adherence behavior, based on targeted manipulation of the five main domains of factors that influence treatment adherence and outcomes.

Not only did our conceptual framework and approach to investigating and influencing adherence provide the first evidence of successful application from a concentrated epidemic but it also yielded one of the largest effect sizes of any similar intervention conducted in a developing country or resource-limited setting. Details have been published elsewhere[47]. On the strength of these evidences and comparable results previously reported from similar studies (using similar conceptual approaches) in generalized epidemics[63,64], we believe that the proposed framework is likely to yield even better results in these settings and therefore merit exploration.

It is instructive to note that health behavioral models are not fool-proof, and no single model can explain 100% variability in adherence behavior; therefore, integrated behavioral interventions are gaining popularity in this regard. To this extent, the main limitation of this and most other health behavior models can be identified as a lack of explicit consideration of non-conscious processes. People are often unaware of their emotional barriers and temptations that guide their actions, and social cognitive approaches to change their behaviors are often not enough[65]. This review did not cover other psychobehavioral models such as information-motivation-behavior model that is not strictly based on any of the social cognition models discussed above but have hitherto been successfully applied for targeted behavioral change in HIV prevention studies.

Conclusion

The advent of potent ART has revolutionized the management of HIV/AIDS, reduced associated morbidity and mortality from HIV-related opportunistic infections, and improved quality of life of patients and their caregivers. As a result, HIV/AIDS metamorphosed from the once fatal disease to a chronic disease requiring the commitment, collaboration, and concerted efforts of all stakeholders (patients, providers, caregivers, policy-makers, community, and other stakeholders) in optimizing the benefits of care.

The goals of HIV treatment are to maximally and durably suppress plasma HIV RNA; restore and preserve immunologic function; reduce HIV-associated morbidity and prolong the duration and quality of survival, and prevent HIV transmission. Adherence to the treatment plan (adherence to medications and scheduled clinic appointments) remains a critical factor in achieving these goals. A strong therapeutic alliance between the provider and patient is not only required to stimulate positive behavioral change and optimize adherence to ART but also to address potential barriers to adherence in a contextual and individualized manner.

In recognition of the serious burden of non-adherence on patients, their caregivers, the health care providers, health-care system and stakeholders, amid global resource limitations, and unmet needs for ART[5], it is now more pertinent than ever before, that researchers, clinicians, and other stakeholders work together to device patient-centered, innovative approaches and methods of investigating and addressing the barriers to adherence in a holistic manner, if we are to achieve the ambitious UNAIDS 90-90-90 global target by 2020. We have presented, in this paper, a basic, evidence-based and adaptable conceptual framework (based on targeted manipulation of the five main domains of factors that influence treatment adherence and outcomes) for inves-

tigating and influencing adherence behavior among HIV-positive populations around the world, regardless of geographical and HIV epidemiological context.

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