

# Self-Management Frameworks for Youth Living with Human Immunodeficiency Virus



Karen Kolmodin MacDonell, PhD<sup>a,\*</sup>, Sylvie Naar, PhD<sup>b</sup>

## KEYWORDS

- Adolescents and emerging adults • Self-management • HIV treatment cascade
- Chronic disease management • Behavioral interventions

## KEY POINTS

- Adolescents and emerging adults continue to represent a substantial proportion of new HIV diagnoses.
- HIV self-management is critical and complex, particularly during adolescence and emerging adulthood.
- Youth can now lead essentially healthy lives with currently available HIV medical care regimens, but there are many challenges to effectively managing HIV.
- For youth living with HIV, self-management goes beyond activities specifically related to treating and caring for HIV along the treatment cascade and includes managing substance use and sexual health because of the impact these activities have on HIV transmission and disease progression.

## SELF-MANAGEMENT FRAMEWORKS FOR YOUTH LIVING WITH HUMAN IMMUNODEFICIENCY VIRUS

Great progress has been made over the past 30 years in the prevention and treatment of HIV. Combination antiretroviral treatment (ART) has transformed infection with HIV from a rapidly debilitating, fatal disease into a chronic condition with high potential for a healthy life for multiple decades.<sup>1,2</sup> Combined with widely available, accurate and rapid HIV-testing, preexposure prophylaxis (PrEP) for individuals

---

<sup>a</sup> Wayne State University School of Medicine, Family Medicine and Public Health Sciences, 1B10 6135 Woodward Avenue, Behavioral Health, H206, Detroit, MI 48202, USA; <sup>b</sup> Florida State University, Center for Translational Behavioral Science, 2010 Levy Avenue Building B, Suite B0266, Tallahassee, FL 32310, USA

\* Corresponding author.

E-mail address: [karen.macdonell@wayne.edu](mailto:karen.macdonell@wayne.edu)

Pediatr Clin N Am 69 (2022) 759–777

<https://doi.org/10.1016/j.pcl.2022.04.007>

[pediatric.theclinics.com](http://pediatric.theclinics.com)

0031-3955/22/© 2022 Elsevier Inc. All rights reserved.

at high-risk, and universal viral suppression for those infected, an AIDS-free generation and the end to the global AIDS epidemic are ambitious, but achievable national and global goals.<sup>3,4</sup> Despite growing optimism about this potentially achievable outcome, the epidemic remains a major cause of morbidity and mortality worldwide, particularly among adolescents and emerging/young adults (hereafter called “youth”) and disproportionately among sexual, gender, and/or racial and ethnic minority youth.<sup>5</sup> Between 2014 and 2018, new HIV diagnoses actually decreased 15% among youth (ages 13–24) overall. Despite this, in 2018, 21% of all new HIV diagnoses in the United States and dependent areas were among youth ages 13 to 24, with gay and bisexual young men disproportionately represented in new diagnoses.<sup>6</sup>

### ***Managing Human Immunodeficiency Virus Among Youth***

---

Adolescents and emerging adults represent a substantial proportion of new HIV diagnoses, but nearly half of all youth living with HIV in the US are not aware that they are infected.<sup>6</sup> Even among those who are aware of their HIV-positive status, far too many struggle with managing HIV as many do not seek treatment, do not remain in treatment over time, fail to take ART as prescribed, particularly over the long-term, and are ultimately not able to achieve HIV viral suppression.<sup>6</sup> Viral suppression occurs when ART reduces a person’s HIV in the blood to an undetectable level, and is essential to maintaining the health of the infected person and preventing further transmission of the virus to other people.<sup>7</sup> The Centers for Disease Control and Prevention (CDC) estimate that only 63.3% of adolescents and emerging adults ages 13 to 24 years with diagnosed HIV infection have achieved viral suppression (in this case, as defined by viral load <200 copies/mL of blood).<sup>8</sup> In 2018, for every 100 young people living with HIV in the US, 55 knew their HIV status, 79 received some HIV medical care, 58 were retained in care, and 60 were virally suppressed.<sup>6</sup> In a recent study of 1411 young people living with HIV ages 12 to 24 across the US, 75% were linked to HIV medical care at adolescent HIV care sites, 59% were engaged in care, and 34% were retained in care. However, only 34% had started ART and 12% had attained viral suppression.<sup>9</sup> These findings strongly suggest that even after youth are linked to an HIV medical care program, a low proportion demonstrate successful disease management including taking ART to achieve viral suppression and attending HIV clinical health care appointments.

The CDC has noted numerous challenges that may make it particularly difficult for adolescents and emerging adults to access the tools they need to manage HIV.<sup>6</sup> Complex, multilevel factors beyond just individual-level factors may contribute to disparities in HIV rates, morbidity, and mortality, particularly in sexual, gender, and/or racial minority youth.<sup>10</sup> Within US samples, barriers may include social and economic challenges such as low income, recent homelessness, recent incarceration, and/or lack of or unstable health insurance.<sup>6</sup> These barriers may be even more significant in minoritized communities because of various forms of discrimination such as homophobia and transphobia. Discrimination may result in a lack of culturally responsive health care,<sup>11</sup> and unequal and unfair treatment across social systems such as housing, education, and criminal justice.<sup>10,12</sup> To end the HIV epidemic, we must find better ways to reduce the risk of HIV transmission, link youth to HIV health care, improve adherence to the HIV care regimen, and keep youth retained in care and adherent to medication over time with the goal of viral suppression. Moreover, we must continue to recognize that sexual, gender, and/or racial/minority youth face significant disparities in all steps of HIV prevention and treatment and beyond.

### ***Managing Substance Use and Sexual Risk Among Youth Living with Human Immunodeficiency Virus***

---

Substance use, particularly marijuana, tobacco, and alcohol use, has been found to be common among youth living with HIV,<sup>13–17</sup> with higher substance use associated with unsuppressed viral load in US and global samples of people living with HIV.<sup>18</sup> Nearly 25% percent of youth living with HIV reported weekly or greater alcohol use in a large multi-site study of youth in clinical care across the United States.<sup>19</sup> Moreover, in this study, nearly 33% of youth reported weekly or more frequent tobacco use, 27.5% reported marijuana use, and 22.5% reported other illicit drug use. Young men-who-have-sex-with-men were more likely to report each substance use behavior, while transgender women were more likely to report marijuana and other illicit drug use than youth in other demographic categories. Overall, youth living with HIV who were involved in the criminal justice system had unstable housing, engaged in condomless (risky) sex, and/or did not take ART as prescribed by their HIV care physician were more likely to use substances in this study.

Substance use may have multiple detrimental social, psychological, and health consequences for youth living with HIV.<sup>19</sup> Alcohol use, in particular, has been found to have synergistic and additive effects on health and common HIV-related comorbidities.<sup>20</sup> Studies with adults living with HIV demonstrate a relationship between alcohol use and accelerated HIV disease,<sup>18,21,22</sup> and there is increasing concern about the detrimental effects of HIV and alcohol use on brain functioning.<sup>23</sup> Alcohol use has also been linked to increased risk behaviors for HIV transmission,<sup>24</sup> poor adherence to ART,<sup>25</sup> worsening disease progression,<sup>26</sup> and has been found to impact HIV care and outcomes at every level (HIV testing, diagnosis, connection to HIV health care, HIV treatment, and viral suppression).<sup>20</sup>

Within adolescents and emerging adults, we know that risk behaviors tend to cluster, with substance use behaviors often cooccurring with other risk behaviors<sup>22</sup> and linked to increased sexual risk behaviors in samples of youth in the US.<sup>18,27,28</sup> Alcohol use, in particular, has been associated with increased risk of engaging in unprotected sex.<sup>24,29</sup> Higher prevalence of sexually transmitted infections (STIs) has also been linked to substance use frequency and/or problematic level of substance use among youth living with HIV in clinical care settings, particularly alcohol, marijuana, and other drugs.<sup>30</sup> Overall, navigating their developing roles as sexual beings is complex for all youth, but even more so for youth with chronic diseases impacting sexual activity or youth whose sexual orientation may increase their likelihood of sexual activity with HIV + individuals.<sup>31</sup> Among adolescent sexual minority males (ages 14–19), one of the groups of youth at elevated risk for HIV transmission in the United States, a recent meta-analysis found that an estimated 67% recently had sex. Among these youth, 44% had condomless anal intercourse within the past 6 months, 50% did not use a condom at last sex, and 32% used alcohol or drugs during their last sexual experience.<sup>32</sup> Despite these increased risks in adolescents and emerging adults, particularly sexual minority youth, there is insufficient research focused on their unique HIV risk and prevention needs; moreover, research evaluating sexual risk-taking, and even more so emerging sexual health needs, among youth living with HIV is limited.

### ***Self-Management of Human Immunodeficiency Virus as a Multi-Faceted Chronic Condition***

---

Despite the multiple challenges facing youth living with HIV, they can now lead essentially healthy lives with currently available HIV medical care regimens. To achieve this goal, a youth must determine their HIV status and become committed to the managing

points along the HIV treatment cascade. The “HIV treatment cascade,” sometimes referred to as the “HIV care continuum,” is a model of the steps people living with HIV go through from initial diagnosis of HIV to achieving viral suppression (Fig. 1). Once HIV-positive status is confirmed, the youth must immediately engage with the HIV care system, initiate ART, and comprehend and embrace the necessity of proper medication adherence, be retained in HIV care, and, finally, maintain viral suppression. Collectively, these steps along the HIV treatment cascade are also what has been called, *HIV self-management*, defined as “strategies to help individuals ...and their caregivers better understand and manage their illness and [or] improve their health behaviors.”<sup>33</sup> This is critical for youth living with HIV because higher self-management has been linked to better adherence to ART, successful viral suppression, and more consistent condom use.<sup>34</sup>

For youth living with HIV, self-management goes beyond activities specifically related to treating and caring for HIV along the treatment cascade (eg, taking ART, attending clinic appointments) and includes managing substance use and sexual health because of the impact these activities have on HIV transmission and disease progression.<sup>17,25,26</sup> HIV self-management is critical and complex at any age, but may be especially challenging among adolescents and emerging adults as they transition from a largely dependent to a more independent status (“transition to self-management”)<sup>35</sup> during developmental periods marked by: identity exploration and self-focus; development of new social networks, increased opportunities and choices, both positive and risk-laden; increased independence and risk-taking behavior (demonstrating the highest level of risk behavior engagement among all age groups); and, decreased parental support and oversight.<sup>36–40</sup> Unfortunately, many youth living with HIV have poor HIV self-management behaviors, including medication adherence<sup>41,42</sup> and retention in HIV care<sup>43</sup> compared with other age groups. Additionally, the prevalence of most kinds of substance use and abuse, including alcohol use,<sup>14,19,44,45</sup> is highest during the transition to adulthood.<sup>38</sup>

A significant substance use concern is smoking behaviors that are highly prevalent among youth living with HIV.<sup>46</sup> Smoking is especially concerning given the increased risk for cardiovascular disease associated with HIV.<sup>47</sup> Using electronic health records, our group has shown that higher cardiovascular disease risk is associated with elevated viral load and reduced immune function.<sup>48</sup> Thus, in addition to reducing smoking, self-management behaviors include general health behaviors that prevent cardiovascular diseases such as nutrition and physical activity, as well as preventive vaccines such as HPV and COVID-19. Additionally, youth living with HIV have to manage side effects resulting from ART medications,<sup>49</sup> as well as potential drug–drug interactions if they are prescribed a medication for any chronic condition beyond HIV (eg, cardiovascular or analgesic medication).<sup>50</sup> As with other chronic conditions, effective self-management is an essential aspect of managing disease, with particular focus on illness prevention and wellness promotion.<sup>51</sup>

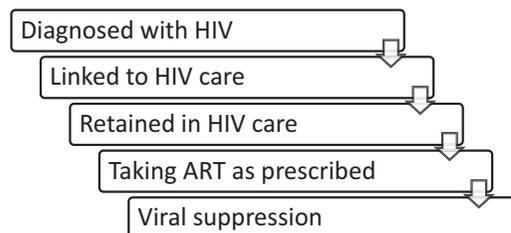


Fig. 1. HIV treatment cascade.

### ***Theoretic Foundation of the Concept of Self-Management***

---

The broad concept of self-management emerged simultaneously within the substance abuse and chronic health condition literatures, and has particular relevance for youth living with HIV given the developmental tasks and challenges of adolescence and emerging adulthood. These challenges include increasing independence, shifting social and emotional supports, transition from pediatric to adult care, increased risk-taking behaviors, and so forth, as described above. For youth living with HIV who are also members of minoritized communities (eg, sexual, gender, and/or racial or ethnic minority groups), these challenges may be compounded with additional exploration of identity, fear of disclosure and/or stigma, and experienced or anticipated stigma.<sup>52</sup>

### ***Self-Management of Substance Use***

---

In substance abuse research, approaches to prevention and intervention in young people have shifted from social influences promoting substance use<sup>53</sup> to cognitive-behavioral personal and social skills needed to resist substance use.<sup>54</sup> Current research now identifies individual-level *self-management skills* such as self-control, decision-making, self-reinforcement, and problem solving as core competencies that protect against substance use and abuse.<sup>55,56</sup> Self-management skills are closely tied to increasing autonomy and agency that characterize the transition to adulthood. These skills are not usually fully developed until adulthood, and mature at different rates across individuals.<sup>56</sup> There is consistent evidence from cross-sectional research that higher self-management skills, particularly planfulness, problem solving, self-reinforcement, and cognitive effort, are linked to lower levels of substance use.<sup>57</sup> Higher self-management skills in early adolescence may even be protective of substance use later in adolescence and early adulthood.<sup>56</sup> There is also evidence that the underlying development of self-management skills is linked to neurologic maturation and connectivity between areas of the brain responsible for self-control and decision-making.<sup>58</sup> Neurobiological research has found regions of the brain responsible for self-management skills do not reach maturity until late adolescence or early adulthood, while those brain areas associated with the processing of social and emotional stimuli develop much earlier in early adolescence.<sup>58</sup> This is one explanation for youths' susceptibility to risk-taking behaviors, including substance use, particularly in the presence of peers.<sup>59</sup>

### ***Self-Management of Pediatric Chronic Medical Conditions***

---

The increased prevalence of chronic health conditions combined with significant reductions in mortality rates for many pediatric conditions has changed how we view chronic health conditions during adolescence and into emerging adulthood.<sup>60</sup> More emphasis has shifted to managing chronic health conditions over the long-term, from childhood, through adolescence, and into the transition to adulthood. In the pediatric chronic health condition literature, *self-management* emerged as a term to broaden the focus from treatment compliance,<sup>61</sup> to medication adherence, and finally, to the range of skills necessary to independently manage a chronic medical condition.<sup>62</sup> Self-management of chronic health conditions refers to the ability to manage symptoms, treatments, lifestyle changes, and consequences of health conditions,<sup>63</sup> take responsibility for one's own health, and use resources effectively toward living a healthier life. This requires skills around problem-solving, goal-setting, and action-planning,<sup>64</sup> as well as specific health behaviors required to effectively manage illness (eg, medication adherence, appointment-keeping).

Self-management may be a particularly useful conceptual framework for adolescents and emerging adults with chronic health conditions, as it assumes autonomy and increasing responsibility for one's own health decisions during the transition from childhood to adulthood. Most chronically ill youth and their caregivers coordinate much of their health care themselves; moreover, many chronic care models that have been incorporated into health care services and clinics do not address the specific needs of youth, particularly as they transition to increasingly independent care.<sup>65</sup> Adolescents and emerging adults face various physical, emotional, and social changes that are often particularly challenging for youth living with chronic health conditions and may negatively impact illness self-management. However, research on youth with chronic conditions has also identified multiple factors that may facilitate better self-management behaviors, including psychosocial factors (eg, higher self-efficacy,<sup>66</sup> positive attitude toward illness,<sup>67</sup> perception of self as "normal" compared with peers<sup>68</sup>), knowledge about their illness, more effective coping skills, and sharing self-management tasks with parents during the transition to independence.<sup>69</sup>

### ***Adapting Frameworks for the Self-Management of Human Immunodeficiency Virus in Youth***

---

Self-management of HIV, and relatedly substance use and sexual health, during adolescence and emerging adulthood is often complicated by the physical, cognitive, and social changes that occur during the process of adolescent development and the challenges associated with both adolescence and emerging adulthood. The concept of self-management emerged from various literatures, most notably substance use and chronic health condition management. A guiding self-management framework may be useful to understand how components of self-management interact and combine to influence HIV-related health behavior and HIV clinical outcomes. Several frameworks have been proposed to illustrate the self-management of HIV in adolescents and emerging adults. These frameworks emphasize different barriers and facilitators to self-management, with varying strengths and weaknesses based on their approaches to understanding HIV self-management.

#### ***Five components model***

The Five Components Model (Fig. 2) was derived from the National Institute of Nursing Research's workshop on improving the quality of life for individuals with chronic health conditions.<sup>33</sup> In this model, self-management is viewed as multiple strategies to help people with chronic conditions and their caregivers better understand and manage their illness and improve their health behaviors. Thus, this model includes the consideration of factors, largely individual-level, that may hinder or facilitate effective illness self-management. Naar, Parsons, and Stanton<sup>70</sup> adapted this model for youth living with HIV, proposing 5 essential skills around illness self-management. These essential skills include: problem solving, decision making, resource utilization, forming of a patient/health care provider partnership, and taking action.<sup>51,71</sup> Problem solving involves understanding the problems, options, as well as downsides and advantages of each option or behavior. This is linked to both decision-making or the youth deciding what works best for themselves, and resource utilization, or the logistical and financial factors that may impact the initial decision. The provider relationship is linked to all steps within this model, and all components have reciprocal associations with one another, ultimately leading to actions taken or not taken to manage HIV. Every step of the HIV treatment cascade, as well as the HIV prevention cascade, requires youth living with HIV to make decisions to engage with the health care system and/or to modify their behaviors; that is, every step requires active self-management. As described earlier,

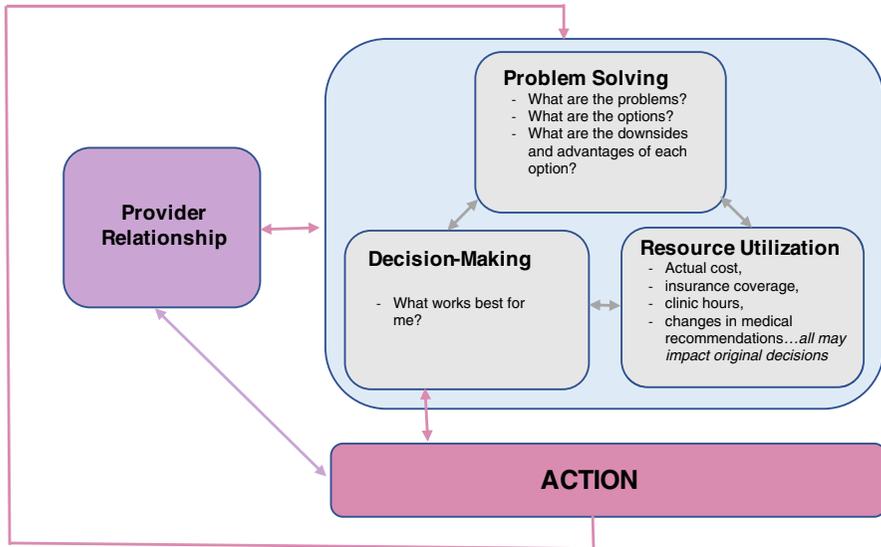


Fig. 2. Five components model of HIV self-management.

few youth actually progress along the HIV treatment cascade from HIV diagnosis to viral suppression.<sup>6,8,9</sup> Moreover, they may be engaging in other risky behaviors such as substance use that interfere across all points in the cascade.<sup>19</sup> In short, these youth are not effectively self-managing their behaviors and not achieving suppressed viral load.

There are many reasons why youth living with HIV may not be effectively self-managing their lives, including impaired problem-solving, decision-making, and/or action-taking. Improved executive function could impact all of these skills positively and may be one important key to improving overall self-management in youth. Executive functioning develops over time as youth mature into adulthood and includes the ability to hold and operate on goal-relevant information in short-term memory, maintain attention in the face of distraction and impulses and flexibly change behavior in response to changing reward contingencies.<sup>72</sup> Better executive functioning in youth is related to better self-control over impulsive behavior, such as drug use and unprotected sex,<sup>73,74</sup> and research in older adults suggests that executive functioning is supportive of prospective memory ability, critical to adhering to medical regimens.<sup>75</sup>

The Five Components Model may be particularly useful for understanding individual-level factors, especially those linked to executive functioning and other cognitive skills (eg, planning, organization) that have been found to impact HIV self-management. However, the model does not extend beyond problem solving, decision making, and the overall contribution of the relationship with health care providers to explain and illustrate self-management. Further, it is not specific to adolescents and emerging adults other than executive functioning and other cognitive factors generally develop and improve over the lifespan,<sup>72</sup> and have been linked to HIV self-management.<sup>76</sup> The model does not include other important influences on health behavior during adolescence and emerging adulthood, such as knowledge of HIV and HIV management, motivation for HIV self-management, influence of peers, and HIV-related stigma. The Five Components model also does not incorporate other important aspects of self-management, namely substance use and sexual-risk-taking

behaviors, that have been found to be highly influential on HIV self-management and viral suppression. Naar, Parsons, and Stanton<sup>70</sup> developed a measurement approach for this Five Components model for a multi-site NIH-funded research program called “Scale it Up.” Data analysis for the measurement model is in progress for a diverse sample of young men who have sex with men and young people living with HIV.

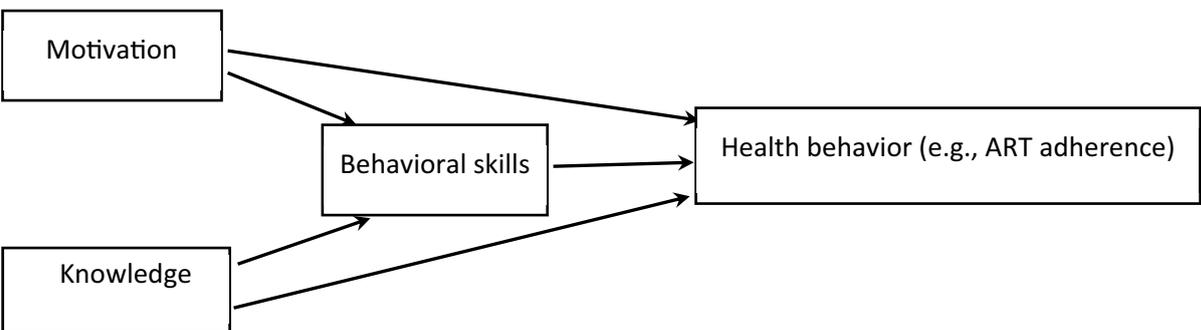
### DEVELOPMENTALLY TAILORED INFORMATION-MOTIVATION-BEHAVIORAL SKILLS MODEL

According to the Information-Motivation-Behavioral Skills (IMB) model (Fig. 3), behavior change results from the joint function of 3 critical components: accurate *information* about risk behaviors (eg, risks of not taking ART as prescribed) or their replacement health behaviors (eg, benefits of taking ART), the *motivation* to change behavior, and the *perceived behavioral skills* necessary to perform the behavior (eg, self-efficacy).<sup>77</sup> Thus, the IMB model posits that behavior or behavior change, typically optimal medication adherence, results from adequate information, motivation to adhere, and perceived and objective ability to adhere. IMB has been used extensively to understand health behavior in diverse groups of people with HIV, including adults in the Deep South,<sup>78</sup> adults beginning PrEP,<sup>79</sup> youth starting ART,<sup>80</sup> and people out of HIV care.<sup>81</sup> The IMB model has been the foundation of many HIV adherence interventions<sup>82,83</sup> and has also been used as a theoretic basis in multiple other studies involving youth with chronic health conditions.<sup>80,84–86</sup> Despite this, there are limited studies of self-management behaviors beyond medication adherence, particularly in adolescents and emerging adults living with HIV.

Our group has proposed a developmentally tailored IMB model shown here (Fig. 4) to address HIV and alcohol self-management specifically among emerging adults. Self-management is conceptualized as the intersection of core competencies (skills) including self-control, decision-making, self-reinforcement, and problem-solving, and health behaviors including appointment and medication adherence, moderation of substance use, reduced sexual risk behavior, and other general health behaviors (eg, sleep). These core competencies and health behaviors were derived from both the substance use and chronic health condition management literatures. Within this model, improved self-management leads to both viral suppression and better alcohol use trajectories, or reductions in the escalation of drinking over time and into adulthood. The developmentally tailored IMB model also includes information about HIV self-management, including knowledge about HIV and the HIV care regimen, knowledge about alcohol and HIV, and the perceived burden of self-management. The model includes key factors related to youths’ developmental stage, specifically youth-specific motivation, or risk perceptions, personal attitudes, personal intentions, social, age-related, and cultural norms, peer values, and stress and stigma. Higher levels of motivation and information are, in turn, associated with better self-management, and improved HIV and alcohol outcomes. Finally, multiple demographic factors such as age, biological sex, race/ethnicity, and sexual and gender identity are proposed as potential moderating factors of the variables and associations within the model.

#### ***Human Immunodeficiency Virus Self-Management Interventions for Youth***

Most studies of self-management interventions have focused on adults, and the intervention literature for youth is still in its infancy. A recent systematic review<sup>87</sup> of self-management interventions for youth living with HIV identified 12 RCTs that addressed HIV knowledge and beliefs, self-regulation, or utilization of resources, with most conducted in the United States. Intervention response was highly varied and very few



**Fig. 3.** The information-motivation-behavioral skills (IMB) model.

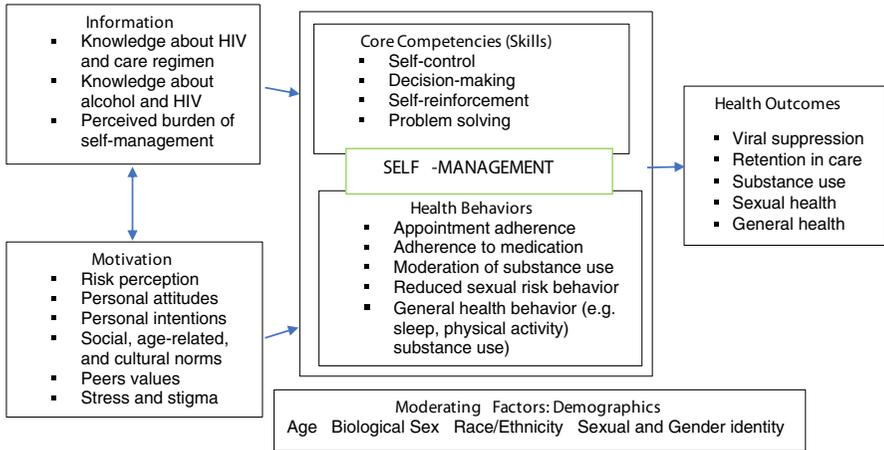


Fig. 4. Developmentally tailored IMB model.

showed effects on viral suppression. For the present article, we identified the few interventions reviewed in Crowley and Rohwer<sup>87</sup> that have shown promise either in full-scale RCTs or in rigorous pilot trials. We also conducted a systematic literature search for any RCTs or rigorous pilot studies fitting the same parameters that were published after the systemic review,<sup>87</sup> but no additional studies were identified. Later in the discussion, we describe the RCTs and rigorous pilot studies included in the Crowley and Rohwer<sup>87</sup> systematic review. These include studies using Motivational Interviewing, supportive accountability, and mindfulness.

Motivational interviewing (MI) is a collaborative, goal-oriented method of communication with particular attention to the language of change<sup>88</sup> that has been adapted for adolescents and emerging adults.<sup>89</sup> MI provides a highly-specified, evidenced-based framework for improving patient-provider communication and promoting behavior change by strengthening a person's intrinsic motivation in an atmosphere of acceptance and compassion. Healthy Choices is a 10-week, four-session manualized intervention that combines MI with personalized feedback on client behavior and goal setting<sup>90</sup> to improve adherence to ART, sexual risk, and substance use in youth living with HIV. In a multi-site randomized trial, youth ages 16 to 24 who were randomized to Healthy Choices plus multidisciplinary specialty care improved viral load at 6 months (3-months posttreatment) compared with youth receiving such care alone.<sup>91</sup> Although in the pilot trial, effects were maintained at 9 months (6 months posttreatment),<sup>92</sup> viral load improvements were not sustained in the larger trial.<sup>91</sup> However, the intervention showed effects on other self-management domains including alcohol use, marijuana use and condom use over 15 months of follow-up.<sup>93,94</sup> In a subsequent comparative effectiveness trial, youth were randomized to home-based delivery of Healthy Choices versus office-based delivery using community health workers.<sup>95</sup> In this trial, the Healthy Choices intervention resulted in improvements in viral load and alcohol use over 12 months. Unexpectedly, the clinic setting outperformed home-based delivery. Of note, participation in the Healthy Choices intervention was also associated with reductions in perceived stigma.<sup>96</sup> Healthy Choices has been adapted for Thai youth<sup>97</sup> and shown to have effects on sexual risk behavior,<sup>98</sup> but its effect on adherence and viral load has not yet been tested in a randomized trial.

The Motivational Enhancement System for Adherence (MESA) is a computer-delivered MI intervention designed to prevent self-management problems in youth

newly beginning ART. Two 30-min sessions are delivered 1-month apart and are based on the Information-Motivation-Behavioral Skills model. The intervention is tailored in several ways<sup>99</sup>: (1) youth choose an avatar who serves as a virtual counselor; (2) the interactive intervention is individualized based on MI principles (eg, the avatar reflects participants' motivational language and affirms behavior change intentions); (3) participants are routed through arms of the program based on their ratings of importance and confidence, and choices for goal setting; (4) participants receive personalized feedback and ART information based on their recent medical information and response to an HIV treatment knowledge questionnaire; (5) participants may choose to read through the intervention screens or be read to, based on their literacy level and choice; and (6) all intervention content was reviewed by youth advisory groups across the country as well as medical, nursing, and psychosocial providers to ensure appropriate tailoring for the cultural context of adolescent HIV in the United States (eg, age appropriateness of language; appropriateness for ethnic and sexual minority youth). In a pilot randomized trial<sup>80</sup> comparing MESA to a similar computer program targeting nutrition and physical activity in young people living with HIV ages 16 to 24, effect sizes for viral load suppression were medium to large at 3 and 6-month follow-up. MESA is currently being tested in a multi-site full-scale trial. Preliminary outcomes suggest that both MESA and the nutrition/activity control group had significant viral load reductions from baseline, which is expected given these youth are newly starting or restarting ART.<sup>100</sup> Control participants had a significantly greater initial decrease immediately following baseline (and starting ART), but MESA had a greater reduction from baseline to post-intervention (3 months). Analyses are ongoing, but results also suggest that the MESA group may have longer sustained reductions in viral load, out to 12 months post-baseline. Additionally, MESA showed significant improvements post-intervention for HIV treatment knowledge and motivation (as importance + confidence) for adherence to ART.<sup>101</sup>

Belzer and colleagues (2014)<sup>102</sup> found that 3 months of cell phone support calls with incentives for answering calls was so effective in improving self-management and viral load compared with standard care that effects were significant at 3 and 6 months in a small sample of 37 youth living with HIV ages 16 to 24. A sequential multiple assignment randomized trial is underway to detangle the effects of text messaging and cell phone support with and without incentives.<sup>103</sup> This trial is also exploring the impact of tapering, or gradually reducing the number of text messages or cell phone support calls received as part of the intervention.

Webb and colleagues<sup>104</sup> randomized 72 young people living with HIV ages 14 to 22 to a mindfulness-based stress reduction (MBSR) group program or to a health education program matched for format, session number, and length. The 9-session MBSR program included didactic material on mindfulness, experiential practice of mindfulness techniques, and discussions on the application of mindfulness to everyday life. Youth in the MBSR condition were more likely to maintain or reduce viral load than the control group, though self-management was not directly assessed.

To our knowledge, there are no controlled trials of interventions to improve appointment adherence or retention in care. However, one pilot study<sup>105</sup> comparing 2 sessions of MI delivered by a peer with MI delivered by a master's level clinician found both groups to improve appointment adherence 1-year postintervention. Interestingly, the peers achieved even higher rates of MI fidelity than the clinicians, suggesting that community health workers could deliver the intervention with proper training and supervision. Although intervention studies addressing smoking, nutrition, and physical activity are beginning to emerge in adults, to our knowledge there are no randomized

trials on smoking cessation or physical activity and nutrition interventions in youth living with HIV.

### ***Clinical Implications***

---

HIV is a multi-faceted disease that creates multiple challenges for adolescents and emerging adults to overcome. Self-management of HIV requires success in multiple domains of health behaviors including medication adherence, retention in HIV care, sexual risk reduction, substance use moderation or abstinence, and general health behaviors such as physical activity, nutrition, and vaccine acceptance. Models of self-management suggest several potential intervention targets. First, having accurate and comprehensive knowledge of the health behaviors required for chronic health condition management and general physical and mental health improvements is a necessary if not sufficient condition. Information should be provided in an interactive way to avoid an “information dump.” Motivational Interviewing (MI) approaches suggest providing information in small chunks and eliciting feedback after each chunk.<sup>88,106,107</sup> The teach-back method<sup>108</sup> is another approach to address health literacy and recommends asking the patient to repeat back health information in their own words.

With regards to motivation, MI addresses intrinsic motivation by eliciting and reinforcing motivational language, emphasizing autonomy, and boosting self-efficacy with affirmations.<sup>109</sup> Examples of interventions to boost extrinsic motivation include contingency management approaches (ie, the young person receives monetary rewards or vouchers for abstinence to substance use or viral suppression).<sup>110</sup> Historically, extrinsic motivation and intrinsic motivation were thought to be polar opposites, with the former undermining the latter. However, investigations about intrinsic and extrinsic motivation in young persons have shown them to be separate phenomena, and not inversely related.<sup>111</sup> Targeting both aspects of motivation may have a synergistic effect.<sup>112</sup> Cognitive-behavioral skills building interventions may be used to increase self-management competencies.<sup>113</sup> and may be adapted to mHealth formats.<sup>114</sup> Finally, further research is necessary to develop interventions to manage stress, stigma, and microaggressions, though mindfulness interventions show some promise.<sup>104</sup>

### **SUMMARY**

Although highly treatable with simplified medication regimens, HIV self-management includes complex and related behaviors including retention in care, medication adherence, managing substance use including tobacco, sexual health behaviors, and general health behaviors such as nutrition, physical activity, and vaccines. MI approaches show significant promise in addressing many aspects of HIV self-management in youth, but further research is necessary especially in the domains of retention in care, tobacco use, and general health behaviors. MI-based interventions typically address several points along the proposed frameworks including information, motivation, and problem-solving. However, intervention development around critical components of self-management particularly in the skills domain is necessary to advance the field. Further intervention development to target stress, trauma, stigma and racism, and micro-aggressions is warranted. There are very few studies testing self-management constructs beyond information and behavior. Further research is necessary to test components of self-management and to assess mechanisms of intervention effects across these self-management frameworks. Finally, self-management frameworks were largely developed with samples from Western countries. The applicability of these constructs globally requires further study.

## CLINICS CARE POINTS

- Assess the multiple behaviors necessary for the self-management of HIV
- Provide information associated with sexual risk, smoking, and other substance use, and general health behaviors in addition to medication adherence and retention in care
- Use empathic and autonomy-supportive communication to ensure alliance in the patient-provider relationship
- Address stressors including stigma, racism, and microaggressions
- Consider motivational interviewing and contingency management to increase motivation for self-management behaviors
- Find resources for cognitive-behavioral skills building interventions to address core competencies

## DISCLOSURE

Authors and research supported by grants from the National Institutes of Health (NIAAA, 1P01AA029547) (S. Naar/K.K. MacDonell), NICHD, 1U19HD089875 (S. Naar), and NIMH, 1R01MH108442 (S. Naar/Outlaw).

## REFERENCES

1. Kanters S, Mills E, Thorlund K, et al. Antiretroviral therapy for initial human immunodeficiency virus/AIDS treatment: critical appraisal of the evidence from over 100 randomized trials and 400 systematic reviews and meta-analyses. *Clin Microbiol Infect* 2014;20(2):114–22.
2. El-Sadr WM, Holmes CB, Mugenyi P, et al. Scale-up of HIV treatment through PEPFAR: a historic public health achievement. *J Acquir Immune Defic Syndr (1999)* 2012;60(Suppl 3):S96.
3. Fauci AS, Folkers GK. Toward an AIDS-free generation. *JAMA* 2012;308(4):343–4.
4. Eisinger RW, Fauci AS. Ending the HIV/AIDS pandemic. *Emerg Infect Dis* 2018;24(3):413.
5. Bosh KA, Hall HI, Eastham L, et al. Estimated annual number of HIV infections—United States, 1981–2019. *Morbidity Mortality Weekly Rep* 2021;70(22):801.
6. CDC. HIV and Youth. Available at: <https://www.cdc.gov/hiv/pdf/group/age/youth/cdc-hiv-youth.pdf>. Accessed February 22, 2020.
7. Eisinger RW, Dieffenbach CW, Fauci AS. HIV viral load and transmissibility of HIV infection: undetectable equals untransmittable. *JAMA* 2019;321(5):451–2.
8. CDC. HIV surveillance data tables. Vol 2, no. 2. Core indicators for monitoring the Ending the HIV Epidemic initiative (early release): National HIV Surveillance System data reported through December 2020; and preexposure prophylaxis (PrEP) data reported through September 2020. 2021. Available at: <https://www.cdc.gov/hiv/library/reports/surveillance-data-tables/vol-2-no-2/index.html>.
9. Kapogiannis BG, Koenig LJ, Xu J, et al. The HIV Continuum of care for adolescents and young adults attending 13 urban US HIV care centers of the NICHD-ATN-CDC-HRSA SMILE collaborative. *J Acquir Immune Defic Syndr* 2020;84(1):92–100.

10. Phillips G, McCuskey D, Ruprecht MM, et al. Structural interventions for HIV prevention and care among US men who have sex with men: a systematic review of evidence, gaps, and future priorities. *AIDS Behav* 2021;25(9):2907–19.
11. Malebranche DJ, Peterson JL, Fullilove RE, et al. Race and sexual identity: perceptions about medical culture and healthcare among Black men who have sex with men. *J Natl Med Assoc* 2004;96(1):97–107.
12. Pager D, Shepherd H. The sociology of discrimination: Racial discrimination in employment, housing, credit, and consumer markets. *Annu Rev Sociol* 2008;34:181–209.
13. Hosek SG, Harper GW, Domanico R. Predictors of medication adherence among HIV-infected youth. *Psychol Health Med* 2005;10(2):166–79.
14. Bruce D, Kahana S, Harper GW, et al. Alcohol use predicts sexual risk behavior with HIV-negative or partners of unknown status among young HIV-positive men who have sex with men. *AIDS care* 2013;25(5):559–65.
15. Alperen J, Brummel S, Tassiopoulos K, et al. Prevalence of and risk factors for substance use among perinatally human immunodeficiency virus–infected and perinatally exposed but uninfected youth. *J Adolesc Health* 2014;54(3):341–9.
16. Elkington KS, Bauermeister JA, Robbins RN, et al. Individual and contextual factors of sexual risk behavior in youth perinatally infected with HIV. *AIDS Patient Care and STDS* 2012;26(7):411–22.
17. Elkington KS, Bauermeister JA, Santamaria EK, et al. Substance use and the development of sexual risk behaviors in youth perinatally exposed to HIV. *J Pediatr Psychol* 2014;40(4):442–54.
18. Ritchwood TD, Ford H, DeCoster J, et al. Risky sexual behavior and substance use among adolescents: a meta-analysis. *Child Youth Serv Rev* 2015;52:74–88.
19. Gamarel KE, Brown L, Kahler CW, et al. Prevalence and correlates of substance use among youth living with HIV in clinical settings. *Drug Alcohol Depend* 2016;169:11–8.
20. Williams EC, Hahn JA, Saitz R, et al. Alcohol use and human immunodeficiency virus (HIV) infection: current knowledge, implications, and future directions. *Alcohol Clin Exp Res* 2016;40(10):2056–72.
21. Williams EC, Joo YS, Lipira L, et al. Psychosocial stressors and alcohol use, severity, and treatment receipt across human immunodeficiency virus (HIV) status in a nationally representative sample of US residents. *Substance Abuse* 2017;38(3):269–77.
22. Cordova D, Huang S, Arzon M, et al. The role of attitudes, family, peer and school on alcohol use, rule breaking and aggressive behavior in hispanic delinquent adolescents. *Open Fam Stud J* 2011;4(Suppl 1-M4):38–45.
23. Rosenbloom MJ, Sullivan EV, Pfefferbaum A. Focus on the Brain: HIV Infection and Alcoholism.
24. Scott-Sheldon LA, Carey KB, Cunningham K, et al. Alcohol use predicts sexual decision-making: a systematic review and meta-analysis of the experimental literature. *AIDS Behav* 2016;20(1):19–39.
25. Hendershot CS, Stoner SA, Pantalone DW, et al. Alcohol use and antiretroviral adherence: review and meta-analysis. *J acquired immune Deficiency Syndromes* 2009;52(2):180–202.
26. Hahn JA, Samet JH. Alcohol and HIV disease progression: weighing the evidence. *Curr HIV/AIDS Rep* 2010;7(4):226–33.
27. Clayton HB, Lowry R, August E, et al. Nonmedical use of prescription drugs and sexual risk behaviors. *Pediatrics* 2016;137(1). <https://doi.org/10.1542/peds.2015-2480>.

28. Córdoba D, Heinze JE, Hsieh HF, et al. Are trajectories of a syndemic index in adolescence linked to HIV vulnerability in emerging and young adulthood? *Aids* 2018;32(4):495–503.
29. Scott-Sheldon LA, Walstrom P, Carey KB, et al. Alcohol use and sexual risk behaviors among individuals infected with HIV: a systematic review and meta-analysis 2012 to early 2013. *Curr HIV/AIDS Rep* 2013;10(4):314–23.
30. Gamarel KE, Nichols S, Kahler CW, et al. A cross-sectional study examining associations between substance use frequency, problematic use and STIs among youth living with HIV. *Sex Transm Infect* 2018;94(4):304–8.
31. Gleit R, Freed G, Fredericks EM. Transition planning: Teaching sexual self-management. *Contemp Pediatr* 2014;31(4):16.
32. Valencia R, Wang LY, Dunville R, et al. Sexual risk behaviors in adolescent sexual minority males: a systematic review and meta-analysis. *J Prim Prev* 2018; 39(6):619–45.
33. Research NIoN. Self-management: Improving quality of life for individuals with chronic illness. 2021. Available at: <https://www.ninr.nih.gov/newsandinformation/iq/self-management-workshop>.
34. Skinner D, Crowley T, Van der Merwe A, et al. Adolescent human immunodeficiency virus self-management: associations with treatment adherence, viral suppression, sexual risk behaviours and health-related quality of life. *South Afr J HIV Med* 2020;21(1):1–11.
35. Giarelli E, Bernhardt BA, Mack R, et al. Adolescents' transition to self-management of a chronic genetic disorder. *Qual Health Res* 2008;18(4):441–57.
36. Arnett JJ. Optimistic bias in adolescent and adult smokers and nonsmokers. *Addict Behav* 2000;25(4):625–32.
37. Arnett JJ. Emerging adulthood. A theory of development from the late teens through the twenties. *Am Psychol* 2000;55(5):469–80.
38. Arnett JJ. The developmental context of substance use in emerging adulthood. *J Drug Issues* 2005;35(2):235–54.
39. Arnett JJ. *Emerging adulthood: the winding road from the late teens through the twenties*. USA: Oxford University Press; 2004.
40. Parsons JT, Halkitis PN, Bimbi D, et al. Perceptions of the benefits and costs associated with condom use and unprotected sex among late adolescent college students. *J Adolesc* 2000;23(4):377–91.
41. Chenneville T, Machacek M, St. John Walsh A, et al. Medication Adherence in 13- to 24-Year-Old Youth Living With HIV. *J Assoc Nurses AIDS Care* 2017; 28(3):383–94.
42. Dinaj-Koci V, Wang B, Naar-King S, et al. A multi-site study of social cognitive factors related to adherence among youth living with HIV in the New Era of antiretroviral medication. *J Pediatr Psychol* 2018;44(1):98–109.
43. Lall P, Lim SH, Khairuddin N, et al. An urgent need for research on factors impacting adherence to and retention in care among HIV-positive youth and adolescents from key populations. *J Int AIDS Soc* 2015;18(2Suppl 1):19393.
44. Naar-King S, Wright K, Parsons JT, et al. Transtheoretical model and substance use in HIV-positive youth. *AIDS care* 2006;18(7):839–45.
45. Naar-King S, Parsons JT, Murphy D, et al. A multisite randomized trial of a motivational intervention targeting multiple risks in youth living with HIV: initial effects on motivation, self-efficacy, and depression. *J Adolesc Health* 2010;46(5): 422–8.
46. Gamarel KE, Westfall AO, Lally MA, et al. Tobacco use and sustained viral suppression in youth living with HIV. *AIDS Behav* 2018;22(6):2018–25.

47. Islam F, Wu J, Jansson J, et al. Relative risk of cardiovascular disease among people living with HIV: a systematic review and meta-analysis. *HIV Med* 2012; 13(8):453–68.
48. Gurung S, Simpson, K.N., Grov, C. et al. Cardiovascular risk profile: A clinic-based sample of youth living with HIV in the U.S. Poster presented at: Conference on Retroviruses and Opportunistic Infections (CROI), March 8-11, 2020; Boston, MA.
49. Masters MC, Krueger KM, Williams JL, et al. Beyond one pill, once daily: Current challenges of antiretroviral therapy management in the United States. *Expert Rev Clin Pharmacol* 2019;12(12):1129–43.
50. Schlaeppi C, Vanobberghen F, Sikalengo G, et al. Prevalence and management of drug–drug interactions with antiretroviral treatment in 2069 people living with HIV in rural Tanzania: a prospective cohort study. *HIV Med* 2020;21(1):53–63.
51. Grady PA, Gough LL. Self-management: a comprehensive approach to management of chronic conditions. *Am J Public Health* 2014;104(8):e25–31.
52. Turan B, Budhwani H, Fazeli PL, et al. How does stigma affect people living with HIV? The mediating roles of internalized and anticipated HIV stigma in the effects of perceived community stigma on health and psychosocial outcomes. *AIDS Behav* 2017;21(1):283–91.
53. Evans RI, Rozelle RM, Mittelmark MB, et al. Deterring the onset of smoking in children: knowledge of immediate physiological effects and coping with peer pressure, media pressure, and parent modeling 1. *J Appl Soc Psychol* 1978; 8(2):126–35.
54. Botvin GJ. Substance abuse prevention research: recent developments and future directions. *J Sch Health* 1986;56(9):369–74.
55. Haegerich TM, Tolan PH. Core competencies and the prevention of adolescent substance use. *N Dir Child Adolesc Dev* 2008;2008(122):47–60.
56. Lowe SR, Acevedo BP, Griffin KW, et al. Longitudinal relationships between self-management skills and substance use in an urban sample of predominantly minority adolescents. *J Drug Issues* 2013;43(1):103–18.
57. Wills TA, Walker C, Mendoza D, et al. Behavioral and emotional self-control: relations to substance use in samples of middle and high school students. *Psychology of addictive behaviors*. *J Soc Psychol Addict Behaviors* 2006;20(3): 265–78.
58. Steinberg L. Should the science of adolescent brain development inform public policy? *Issues Sci Technol* 2012;28(3):67–78.
59. Chein J, Albert D, O'Brien L, et al. Peers increase adolescent risk taking by enhancing activity in the brain's reward circuitry. Wiley Online Library; 2011.
60. Perrin JM, Bloom SR, Gortmaker SL. The increase of childhood chronic conditions in the United States. *JAMA* 2007;297(24):2755–9.
61. Fielding D, Duff A. Compliance with treatment protocols: interventions for children with chronic illness. *Arch Dis Child* 1999;80(2):196–200.
62. Phillips GA, Fenton N, Cohen S, et al. Peer reviewed: self-management and health care use in an adolescent and young adult medicaid population with differing chronic illnesses. *Preve Chronic Dis* 2015;12:E103.
63. Barlow J, Wright C, Sheasby J, et al. Self-management approaches for people with chronic conditions: a review. *Patient Educ Couns* 2002;48(2):177–87.
64. Coleman MT, Newton KS. Supporting self-management in patients with chronic illness. *Am Fam Physician* 2005;72(8):1503–10.

65. Miller AR, Recky MA, Armstrong RW. Responding to the needs of children with chronic health conditions in an era of health services reform. *CMAJ* 2004; 171(11):1366–7.
66. Rhee H, Wicks MN, Dolgoff JS, et al. Cognitive factors predict medication adherence and asthma control in urban adolescents with asthma. *Patient Prefer Adherence* 2018;12:929–37.
67. Amer KS. Children's views of their adaptation to type 1 diabetes mellitus. *Pediatr Nurs* 2008;34(4):281.
68. Jedeloo S, van Staa A, Latour JM, et al. Preferences for health care and self-management among Dutch adolescents with chronic conditions: a Q-methodological investigation. *Int J Nurs Stud* 2010;47(5):593–603.
69. Lindsay S, Kingsnorth S, Hamdani Y. Barriers and facilitators of chronic illness self-management among adolescents: a review and future directions. *J Nurs Healthc Chronic Illness* 2011;3(3):186–208.
70. Naar S, Parsons JT, Stanton BF. Adolescent trials network for HIV-AIDS scale it up program: protocol for a rational and overview. *JMIR Res Protoc* 2019;8(2): e11204.
71. Health CftAo. Essential elements of self-management interventions. Washington DC: Center for the Advancement of Health; 2002.
72. Miyake A, Friedman NP, Emerson MJ, et al. The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cogn Psychol* 2000;41(1):49–100.
73. Khurana A, Romer D, Betancourt LM, et al. Stronger working memory reduces sexual risk taking in adolescents, even after controlling for parental influences. *Child Dev* 2015;86(4):1125–41.
74. Khurana A, Romer D, Betancourt LM, et al. Experimentation versus progression in adolescent drug use: a test of an emerging neurobehavioral imbalance model. *Dev Psychopathol* 2015;27(3):901–13.
75. Hering A, Rendell PG, Rose NS, et al. Prospective memory training in older adults and its relevance for successful aging. *Psychol Res* 2014;78(6):892–904.
76. Nichols SL, Chernoff MC, Malee KM, et al. Executive functioning in children and adolescents with perinatal HIV infection and perinatal HIV exposure. *J Pediatr Infect Dis Soc* 2016;5(suppl\_1):S15–23.
77. Fisher WA, Fisher JD, Harman J. The information-motivation-behavioral skills model: a general social psychological approach to understanding and promoting health behavior. *Social Psychol Foundations Health Illness* 2003;82–106.
78. Amico KR, Barta W, Konkle-Parker DJ, et al. The information-motivation-behavioral skills model of ART adherence in a Deep South HIV+ clinic sample. *AIDS Behav* 2009;13(1):66–75.
79. Dubov A, Altice FL, Fraenkel L. An information–motivation–behavioral skills model of PrEP uptake. *AIDS Behav* 2018;22(11):3603–16.
80. Naar-King S, Outlaw AY, Sarr M, et al. Motivational enhancement system for adherence (MESA): pilot randomized trial of a brief computer-delivered prevention intervention for youth initiating antiretroviral treatment. *J Pediatr Psychol* 2013;38(6):638–48.
81. Horvath KJ, Smolenski D, Amico KR. An empirical test of the information-motivation-behavioral skills model of ART adherence in a sample of HIV-positive persons primarily in out-of-HIV-care settings. *AIDS Care* 2014;26(2): 142–51.

82. Fisher JD, Amico KR, Fisher WA, et al. The Information-Motivation-Behavioral Skills model of antiretroviral adherence and its applications. *Curr HIV/AIDS Rep* 2008;5(4):193–203.
83. Whiteley L, Brown LK, Mena L, et al. Enhancing health among youth living with HIV using an iPhone game. *AIDS care* 2018;30(sup4):21–33.
84. Kolmodin MacDonell K, Naar S, Gibson-Scipio W, et al. The detroit young adult asthma project: proposal for a multicomponent technology intervention for african american emerging adults with asthma. *JMIR Res Protoc* 2018;7(5):e98.
85. MacDonell K, Naar S, Gibson-Scipio W, et al. The detroit young adult asthma project: pilot of a technology-based medication adherence intervention for african-american emerging adults. *J Adolesc Health* 2016;59(4):465–71.
86. Rongkavilit C, Naar-King S, Kaljee LM, et al. Applying the information-motivation-behavioral skills model in medication adherence among Thai youth living with HIV: a qualitative study. *AIDS Patient Care and STDs* 2010;24(12):787–94.
87. Crowley T, Rohwer A. Self-management interventions for adolescents living with HIV: a systematic review. *BMC Infect Dis* 2021;21(1):431.
88. Miller WR, Rollnick S. *Motivational interviewing: helping people change*. Guilford press; 2012.
89. Naar S, Suarez M. *Motivational interviewing with adolescents and young adults*. Guilford Publications; 2021.
90. Naar-King S, Wright K, Parsons J, et al. Healthy choices: motivational enhancement therapy for health risk behaviors in HIV+ Youth. *AIDS Educ Prev* 2006;18(1):1–11.
91. Naar-King S, Parsons JT, Murphy DA, et al. Improving health outcomes for youth living with the human immunodeficiency virus: a multisite randomized trial of a motivational intervention targeting multiple risk behaviors. *Arch Pediatr Adolesc Med* 2009;163(12):1092–8.
92. Naar-King S, Lam P, Wang B, et al. Brief report: maintenance of effects of motivational enhancement therapy to improve risk behaviors and HIV-related health in a randomized controlled trial of youth living with HIV. *J Pediatr Psychol* 2008;33(4):441–5.
93. Murphy DA, Chen X, Naar-King S, et al. Alcohol and marijuana use outcomes in the healthy choices motivational interviewing intervention for HIV-positive youth. *AIDS Patient Care and STDs* 2012;26(2):95–100.
94. Chen X, Murphy DA, Naar-King S, et al. A clinic-based Motivational Intervention Improves condom use among subgroups of youth living with HIV. *J Adolesc Health* 2011;49(2):193–8.
95. Naar S, Robles G, MacDonell K, et al. Comparative effectiveness of community vs clinic healthy choices motivational intervention to improve health behaviors among youth living with HIV: a randomized trial. *JAMA Open Netw* 2020;3(8):e2014659.
96. Budhwani H, Robles G, Starks TJ, et al. Healthy choices intervention is associated with reductions in stigma among youth living with HIV in the United States (ATN 129). *AIDS Behav* 2020;1–9.
97. Rongkavilit C, Naar-King S, Koken JA, et al. A feasibility study of motivational interviewing for health risk behaviors among Thai youth living with HIV. *J Assoc Nurses AIDS Care* 2014;25(1):92–7.
98. Rongkavilit C, Naar-King S, Wang B, et al. Motivational Interviewing Targeting Risk Behaviors for Youth Living with HIV in Thailand. *AIDS Behav* 2013;17(6):2063–74.

99. Outlaw AY, Naar-King S, Tanney M, et al. The initial feasibility of a computer-based motivational intervention for adherence for youth newly recommended to start antiretroviral treatment. *AIDS Care* 2014;26(1):130–5.
100. Hoenigl M, Chaillon A, Moore DJ, et al. Rapid HIV viral load suppression in those initiating antiretroviral therapy at first visit after HIV diagnosis. *Scientific Rep* 2016;6(1):1–5.
101. Outlaw A, MacDonell K, Templin JL, Naar S. Motivational Enhancement System for Adherence (MESA) for Youth Starting or Restarting Antiretroviral Therapy (ART): Findings from A Multi-site Study. Article presented at. International Association of Providers of AIDS Care (IAPAC), Adherence; March 2020;8-11.
102. Belzer ME, Naar-King S, Olson J, et al. The use of cell phone support for non-adherent HIV-infected youth and young adults: an initial randomized and controlled intervention trial. *AIDS Behav* 2014;18(4):686–96.
103. Belzer ME, MacDonell KK, Ghosh S, Naar S, McAvooy-Banerjea J, Gurung S, Cain D, Fan CA, Parsons JT. Adaptive Antiretroviral Therapy Adherence Interventions for Youth Living With HIV Through Text Message and Cell Phone Support With and Without Incentives: Protocol for a Sequential Multiple Assignment Randomized Trial (SMART). *JMIR Res Protoc* 2018;7(12). <https://doi.org/10.2196/11183>. e11183.
104. Webb L, Perry-Parrish C, Ellen J, et al. Mindfulness instruction for HIV-infected youth: a randomized controlled trial. *AIDS Care* 2018;30(6):688–95.
105. Naar-King S, Outlaw A, Green-Jones M, et al. Motivational interviewing by peer outreach workers: a pilot randomized clinical trial to retain adolescents and young adults in HIV care. *AIDS Care* 2009;21(7):868–73.
106. Miller WR, Rollnick S. *Motivational interviewing: preparing people for change* Guilford. New York. 2002.
107. Miller WR, Rollnick S, Moyers TB. *Motivational interviewing*. University of New Mexico; 1998.
108. Ha Dinh TT, Bonner A, Clark R, et al. The effectiveness of the teach-back method on adherence and self-management in health education for people with chronic disease: a systematic review. *JBI Evid Synth* 2016;14(1):210–47.
109. Naar-King S, Suarez M. *Motivational interviewing with adolescents and young adults*. Guilford Press; 2011.
110. Letourneau EJ, McCart MR, Sheidow AJ, et al. First evaluation of a contingency management intervention addressing adolescent substance use and sexual risk behaviors: Risk reduction therapy for adolescents. *J Substance Abuse Treat* 2017;72:56–65.
111. Lepper MR, Corpus JH, Iyengar SS. Intrinsic and extrinsic motivational orientations in the classroom: age differences and academic correlates. *J Educ Psychol* 2005;97(2):184–96.
112. Carroll KM, Easton CJ, Nich C, et al. The use of contingency management and motivational/skills-building therapy to treat young adults with marijuana dependence. *J Consult Clin Psychol* 2006;74(5):955.
113. DAR SON, SER NME. *Cognitive-behavioral therapy to promote self-management. Promoting Self-Management of Chronic Health Conditions: Theories and Practice*. 2017:31.
114. Cooper V, Clatworthy J, Whetham J, et al. mHealth interventions to support self-management in HIV: a systematic review. *Open AIDS J* 2017;11:119.