PsYchosocial Interventions to Enhance Treatment Adherence to Lifestyle Changes in Cardiovascular Disease: A Review of the Literature 2011-2021

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INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of death globally (World Health Organization, 2020) and as life expectancy increases and people live more years with cardiac disease, it is reasonable to anticipate an increased demand of patients for better quality of life. Gene mutations (Muka et al., 2016), heredity (Hanson, 2019), and psychosocial factors may be implicated in cardiac disease triggering and relapse (Everson-Rose and Lewis, 2005). Lifestyle may also play a significant role in the increased prevalence of cardiac disease seen in developed countries. Globally, smoking, physical inactivity, high blood cholesterol, high blood pressure, unhealthy diet, risky alcohol consumption, poor sleep and emotional stress are the main lifestyle risk factors for CVDs (Benjamin et al., 2019). Common therapeutic recommendations include pharmacotherapy and lifestyle risk factor modifications (Iestra et al., 2005). Patients with cardiovascular diseases often experience difficulties in following these lifestyle recommendations and this compromises treatment effectiveness with enormous consequences on health and economics (Cutler et al., 2018). Adherence to long-term therapies for chronic illnesses such as...
Cardiovascular diseases in developed countries average 50% and the rates are even lower in developing countries (World Health Organization, 2003).

Studies indicate patients are more actively involved in their treatment when they feel that they participate and less so when they are required to passively comply to a list of guidelines (Gould and Mitty, 2010). Hence, in recent studies the term adherence is favored over the term compliance (Tilson, 2004). According to the World Health Organization, treatment adherence is the extent to which a person’s behavior corresponds with the agreed recommendations-taking medication, following a diet and executing lifestyle changes from a healthcare provider (Sabaté and Cluster, 2001). Adherence is differentiated from passive behavior “doing as I told” and it is an active and positive behavior in which a patient and doctor work together for treatment.

Lifestyle modifications are not always a straightforward endeavor and they often undermine the already frail psychology of these patients. There are many reasons that patients have difficulties adhering to treatment (Leslie et al., 2019). According to one of the most influential theories of social psychology, the Cognitive Dissonance Theory as presented by Festinger in 1957, despite people knowing the negative impacts of an unhealthy habit as tobacco smoking, they continue to smoke. Cognitive dissonance occurs when a person holds contradictory thoughts, beliefs, or values and in order to reduce discomfort and psychological stress strive for internal psychological consistency (Pepitone & Festinger, 1959). Even the most beneficial lifestyle modifications may instigate conflicting attitudes, trigger anxiety and discomfort, and lead people to defer or completely abandon efforts (Kiecolt, 1994).

| Factors Identified to Influence Non-Adherence to Lifestyle Recommendations |
|---|
| Treatment resistance is multifactorial and may be related to determinants of the disease itself, including severity of symptoms and patient functionality (Miller, 1997). In addition, asymptomatic patients are more prone to underestimating the seriousness of their health condition and are less likely to adhere to recommendations for lifestyle modifications (Miller, 1997). Studies show that longer duration of treatment and more lifestyle modifications increase the likelihood for non-adherence to treatment (World Health Organization, 2003) (see Table 1). Moreover, the lack of information and education regarding the disease and the measures to improve patients' lives inhibits therapeutic adherence and bolster false assumptions about treatment (Brown & Bussell, 2011). Specific circumstances, including fatigue (Kessing et al., 2016) memory and attention deficits (Ali et al., 2017; van der Laan et al., 2019) negative beliefs about treatment (Horne and Weinman, 1999) and external locus of health control (Taher et al., 2015), may lead patients to abandon treatment. Patients working in shifts with an irregular work schedule seem to have more difficulties following recommendations compared to patients with steady hour jobs (Shan et al., 2018). Comorbidity also represents an important limiting factor. Patients dealing with more than one serious illnesses, taking multiple medications or with concomitant mental disorders (DiMatteo et al., 2000; Gehi et al., 2005) are less likely to adhere to treatment; for that reason, a thorough medical history before establishing a treatment plan is of paramount importance patients’ diligence in following non-pharmaceutical instructions may be influenced to a significant degree by socioeconomic factors. Patients living isolated and without social support are less likely to adhere to treatment (Aggarwal et al., 2010). Lack of reinforcement kam motivation for lifestyle modifications may lead to behavioral relapses |

Table 1. Modifiable factors for non-adherence to treatment in heart patients

| Condition related factors | Lifestyle changes recommendations |
|----------------------------|----------------------------------|
| Long term treatment (World Health Organization, 2005) | **Lack of information/education on CVDs (Brown and Bussell, 2011)** |
| Severity of the disease (Miller, 1997) | **Fatigue (Kessing et al., 2016)** |
| Intensity of symptoms | **Difficulty in memory and concentration forgetfulness (Ali et al., 2017)** |
| Lack of functionality (World Health Organization, 2005) | **Shifts at work (Shan et al., 2018)** |
| Asymptomatic patients (Miller, 1997) | **Beliefs (Horne and Weinman, 1999)** |

| Treatment-related factors | Lifestyle changes recommendations |
|---------------------------|----------------------------------|
| Conflicting therapeutic recommendations/nonspecific Instructions (Carpenter et al., 2010) | **Lack of information/education on CVDs (Brown and Bussell, 2011)** |
| Complexity of treatment (Choudhry et al., 2011) | **Fatigue (Kessing et al., 2016)** |
| **Difficulties in memory and concentration forgetfulness (Ali et al., 2017)** | **Shifts at work (Shan et al., 2018)** |
| **Beliefs (Horne and Weinman, 1999)** | **Lack of information/education on CVDs (Brown and Bussell, 2011)** |

| Patient oriented and psychosocial factors | Lifestyle changes recommendations |
|------------------------------------------|----------------------------------|
| Reduced cost of therapies (Iuga and McGuire, 2014) | **Fatigue (Kessing et al., 2016)** |
| Comorbidity (mental illness, stress) (Favaro et al., 2011; Gehi et al., 2005) | **Difficulty in memory and concentration forgetfulness (Ali et al., 2017)** |
| Cognitive dissonance (Pepitone & Festinger, 1959) | **Shifts at work (Shan et al., 2018)** |
| Social isolation and lack of support (Albus, 2010) | **Beliefs (Horne and Weinman, 1999)** |
| Negative reinforcement (Byiers et al., 2014) | **Lack of information/education on CVDs (Brown and Bussell, 2011)** |
| External locus of control (Taber et al., 2015) | **Fatigue (Kessing et al., 2016)** |

| Health care factors | Lifestyle changes recommendations |
|---------------------|----------------------------------|
| Difficulty of access (Iuga and McGuire, 2014) | **Fatigue (Kessing et al., 2016)** |
| Long hospital waits (Thornton et al., 2020) | **Difficulty in memory and concentration forgetfulness (Ali et al., 2017)** |
| Impersonal doctor-patient relationship (Olshansky, 2007) | **Shifts at work (Shan et al., 2018)** |

| Cultural factors | Lifestyle changes recommendations |
|------------------|----------------------------------|
| Trust in the health care system (King-Shier et al., 2018) | **Fatigue (Kessing et al., 2016)** |
| High in fat and calories food | **Difficulty in memory and concentration forgetfulness (Ali et al., 2017)** |
| High frequency of social gatherings and excessive use of cars (Serour et al., 2007) | **Shifts at work (Shan et al., 2018)** |
The financial burden is another deterring factor, especially when treatment costs are not fully or at least partly covered by the insurance (Iuga and McGuire, 2014). Even patients with initially increased adherence to treatment may change their attitude over time; this may be attributed to certain impeding aspects of the healthcare system, including difficult access to examination sites (Martin et al., 2005) higher recurrent visit frequency, longer waiting times (Thornton et al., 2020) and impersonal healthcare professionals (Olshtansky, 2007). Finally, cultural factors, including ethnic dietary patterns, high frequency of social gatherings (King-Shier et al., 2018) and excessive use of cars, may affect the degree of difficulty patients are facing when required to follow recommendations (Serour et al., 2007). Understanding the aforementioned factors is important for adopting managing strategies, as they indirectly contribute to worse prognosis of cardiovascular patients (Unverzagt et al., 2016), repetitive readmissions to hospital and premature death (van der Wal et al., 2010).

**Purpose of the Study**

We performed a review of the literature spanning the decade 2011-2021 concerning the factors favoring adherence of cardiovascular patients to recommendations for lifestyle modifications. Over the past decade, many interventions have been conducted to improve treatment adherence to lifestyle modification. We collected all the studies covering the period 2011-2021 in a review in order to identify the most effective interventions and contributing to the enlightening of health practitioners. Secondarily our review can be a tool that will strengthen the heart patient’s attitude towards his treatment and we hope will lead to a new way of thinking and action on treatment adherence to the long-term therapies of patients with cardiovascular diseases.

**METHOD**

**Inclusion and Exclusion Criteria**

For the present review, studies were obtained from eight electronic databases (Pubmed, PsycLIT, Coughraine Librady, Scopus, CINAh, PSIinfo, Web of Science, and Central); we also performed a search of the grey literature in order to reduce publication bias. Inclusion criteria were studies published between 2011 and 2021, involving adults with cardiovascular disease. The 10-year time-frame was chosen in order to capture the most recent trends and to have a more manageable number of studies. Additionally, we included studies written in English, with the word "adherence" in the title or in the abstract. Although adherence and compliance terms are often used interchangeably, the latter has a more negative connotation, as it describes a passive behavior in which patients are following a list of guidelines given from the clinical practitioners. Nowadays, the term adherence is preferable, as it bears a more positive meaning and implies a collaboration between health professionals and the patient. We included articles containing the term "compliance", provided there was active patient involvement. Moreover, we included studies investigating the effectiveness of interventions emphasizing exclusively on lifestyle recommendations for improving treatment adherence. Studies attempting to identify predictors for non-adherence or for pharmaceutical adherence were not included.

**RESULTS**

A total of forty-two articles met the inclusion/exclusion criteria and comprised the sample for this review. The included studies included a variety of study designs: 13 observational studies, 8 correlational design, 4 quasi-experimental research, 5 randomized clinical trials, 12 systematic & meta-analysis review. They were conducted in the following countries: Netherlands (5), Australia (2), UK (6), China (2), Germany (1), Canada (2), Egypt (1), Ethiopia (1), South Korea (2), Poland: (5), Finland (1), Jordan (4), Sweden (1), Italy (2), Pakistan (1), Brazil (2), USA (2), France (1), Spain (1), and Iran (2).

**Interventions to Enhance Treatment Adherence to Lifestyle Change Recommendations**

**Cardiac rehabilitation programs**

Cardiac rehabilitation is a multidisciplinary and individualized intervention designed to improve patients’ quality of life; they include exercise, nutritional support, stress management techniques, and psychoeducation. These programs may contribute to modification of lifestyle behaviors, as participants may feel more secure exercising under specialist supervision. Participation of patients in supervised cardiac rehabilitation programs may increase adherence to treatment and contribute to positive lifestyle changes, including increased physical activity.

**Improving knowledge and health education**

Increased awareness may substantially enhance understanding of factors affecting health and illness and may help patients adhere to therapeutic instructions. Knowledge leads to reduced anxiety and better sense of control. In addition, patients that are actively involved in the educational process are more likely to adopt positive lifestyle changes compared to those that are passive receivers of information.

**Strengthen the therapeutic relationship**

Treatment alliance is an important aspect in treatment process and it can have a strong impact in health outcomes. A productive therapeutic relationship will increase treatment adherence. Cultivation a feeling of participation rather than obedience will allud patient to feel safe and understood. Moreover, patients that are given frequent reminders from health practitioners, those that can have prompt access to a physician for an instant consult, as well as those that undergo individualized treatment have more positive feelings and trust for their physician and their treatment.

**Patient-tailored and behavioral interventions**

Behavioral interventions are of paramount importance for modifying patient attitudes and behaviors. Positive feedback and negative feedback elimination, as well as desensitization to reduce fears regarding treatment are examples of techniques that enhance adherence to treatment. Change of behavior requires time, gradual empowerment and motivation.
during all steps involved. Behavioral interventions are beneficial for patients with resistance to treatment; history of treatment dropouts; depression; decreased motivation; and unhealthy lifestyle habits. Reinforcement is key to successful behavior change strategies.

**Early detection of resistance to treatment**

A potential tool detecting patient adherence to treatment and their ability to exert self-control will greatly assist in achieving individualized management. The Theory of Planned Behavior (TPB) is a social cognitive model that predicts an individual’s intention to engage in a behavior at a specific time and place. TPB has been used successfully to predict treatment adherence in chronic illness and therefore is an important tool for health care providers in cardiovascular diseases (Mckenna, 1996; Rich et al., 2015). Moreover, timely detection of mental disorders may contribute to developing an individualized therapeutic scheme that takes into account the mental and physical needs of each patient.

**Beliefs, attitudes, and internal locus of control**

People believing that their behavior greatly determines their health status are more likely to change their lifestyle in order to improve their health. On the other hand, those believing that their health is mostly determined by unpredictable factors rather than behavior are less probable to proceed in major lifestyle modifications. Health practitioners should encourage patients to embrace a more responsible outlook on their health.

**Stress management techniques**

Psychological support, with interventions including emotion management, incentivization, realistic goal setting, can positively affect mental and physical status of cardiovascular patients. Replacing harmful habits with healthier ones is extremely important for treatment success. The psychologist plays the role of the patient’s partner, detecting and helping them deal with their fears, anxieties and other obstacles encountered during the process of changing lifestyle. Relaxation techniques help reducing stress and anxiety regarding disease, as stress may lead to emergence and persistence of unhealthy behaviors such as consuming junk food, smoking and inactivity. Stress management may contribute to therapeutic adherence and prevention of recurrences.

**Enhancement self-care and self-efficacy**

Self-efficacy seems to be a predictor for treatment adherence and interventions that enhance self-efficacy could play an important role in disease management and self-care behaviors.

**Family and community support**

The support provided by family members and friends is very important to the patient. Involving friends and family in treatment may improve patient’s perspective and assist in practical issues, as encouraging and supporting exercise. In fact, in order to support a patient, friends and family members frequently adopt positive changes in their lifestyle as well, sowing the seeds of good health.

**Use of technology for monitoring, organizing, motivation, and reminding**

The use of a reminder device may assist adherence to both treatment and lifestyle changes. Smartphone applications reminding and encouraging exercise, diet control and relaxation techniques have been proven helpful for patients with memory deficits or with lack of motivation. Tailored tele monitoring was found also effective to educate patients with HF and to improve their self-care abilities and sense of self-efficacy.

**Regular outpatient contact, follow up and visits**

Frequent communication using phone calls, texting, and healthcare provider visits is positively viewed by patients and may help them maintain focus on their goals and adhere to the treatment plan.

Table 2 and Table 3 summarizes our review in this study.

### Table 2. Characteristics of studies that integrated treatment adherence for lifestyle recommendations included in this review

| Lead author       | Year | Journal of publication                          | Type of study               | Population                                      | Factors enhance adherence                                                                 |
|-------------------|------|-------------------------------------------------|-----------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------|
| Sol et al.        | 2011 | European Journal of Cardiovascular Nursing     | Observational cohort study  | 25 patients with cerebrovascular disease, CHD, or peripheral arterial disease | Self-efficacy improved adherence to physical activity and food choices                      |
| Heydari et al.    | 2011 | Journal of Cardiovascular Nursing               | Descriptive correlational design | 108 HF patients                       | Patients perceive their therapeutic regimen as a challenge                                  |
| Baljani et al.    | 2012 | Avicenna Journal of Nursing & Midwifery Care    | Quasi-experimental research  | 92 patients with cardiovascular disease         | Using self-management interventions can be helpful in adhering to medication regimen and changing lifestyle in choosing low fat diet. |
|                   |      |                                                 |                             |                                                 | In patients with cardiovascular diseases whom specialists have desired long-term lifestyle changes, self-management is in effective measure that increases their control over their condition. |
| Martin and Woods  | 2012 | Journal of Aging and Physical Activity          | Correlational study         | 24 long-term adherers after cardiac event       | Belief in health benefits, structure class emotional social support self-efficacy           |
| Guiraud et al.    | 2012 | Archives of Physical Medicine and Rehabilitation| Prospective and randomized study | 29 patients                              | Telephone support based on accelerometer                                                   |
| Lead author                  | Year | Journal of publication | Type of study                                      | Population | Factors enhance adherence                                                                 |
|-----------------------------|------|------------------------|---------------------------------------------------|------------|------------------------------------------------------------------------------------------|
| Marti et al.                | 2013 | Congestive Heart Failure | Prospective cohort study                          | 308 HF patients | Age - Self-care education. Lower resource utilization and better health status.            |
| Nieuwenhuis et al.          | 2012 | Elsevier               | Descriptive, prospective design                   | 648 patients with HF | Knowledge on HF and educational support. Positively affected compliance with weighing and fluid restriction but not exercise. |
| Griffio et al.              | 2013 | International Journal of Cardiology | Prospective, longitudinal, multicenter registry with on-line web-based data collection | 1,262 patients after coronary artery bypass grafting CABG or PCI | Effective secondary prevention through cardiac rehabilitation. |
| Tawalbeh and Ahmad          | 2014 | Clinical Nursing Research | Group pretest-posttest study design               | 153 CAD patients | Cardiac educational program. Predischare education participants from the experimental group scored significantly higher on three components of healthy lifestyle, health responsibility, nutrition, and interpersonal relations. |
| Eshah et al.                | 2013 | Nursing & Health Sciences | Quasi-experimental research                       | 104 ACS    | Self-efficacy mediated the associations of social support and depression with treatment adherence. |
| Maeda et al.                | 2013 | International Journal of Behavioral Medicine | Correlational study                              | 252 chronic HF patients | Self-regulation lifestyle program effects on exercise levels at 6 months post cardiac rehabilitation. |
| Janssen et al.              | 2013 | Journal of Behavioral Medicine | Correlational study                              | 210 post cardiac rehabilitation patients | Autonimous motivation. |
| Slovinec et al.             | 2014 | Health Psychology      | Prospective, longitudinal design                  | 801 patients hospitalized for CHD | Live with family. Three or more previous nursing appointments. |
| D’Angelo et al.             | 2017 | Clinical Nursing Research | Randomized controlled trial                       | 111 HF patients | Lower functional status. Social support, greater knowledge of heart failure. |
| Boyne et al.                | 2014 | European Journal of Cardiovascular Nursing | Randomized controlled trial                       | 382 patients with HF | Tailored tele-monitoring. |
| Silva et al.                | 2015 | Revista Latino-Americana de Enfermagem | Cross-sectional study                             | 340 HF patients | Corelation research. 280 outpatient with heart failure. |
| Urbiniti et al.             | 2015 | European Journal of Preventive Cardiology | Correlational study                              | 11,706 patients with AMI | Live and diet. |
| Ok and Choi                 | 2015 | Korean Journal of Adult Nursing | Correlational research                            | 174 ticagrelor-treated MI patients | Use of an interactive patient support tool. |
| Johnston et al.             | 2016 | American Heart Journal  | Multicenter, randomized trial                     | 160 patients | It is documented that SMS is effective in improving adherence to a healthy diet and medication. SMS could be a promising solution for management of different chronic diseases. |
| Akhu-Zaheya and Shiya        | 2017 | International Journal of Medical Informatics | Randomized controlled trial                       | 416 post- percutaneous coronary intervention patients | Male gender, close personal relationship, longer education, and lower LDL-cholesterol. Longer duration of coronary heart disease without previous percutaneous coronary intervention. |
| Kähkönen et al.             | 2018 | International Committee of Medical Journal Editors | Analytical multi-hospital survey study           | 170 HF patients | Cognitive function is an independent contributor. Being in a relationship education are independent predictors of better compliance. |
### Table 2 (Continued). Characteristics of studies that integrated treatment adherence for lifestyle recommendations included in this review

| Lead author            | Year | Journal of publication                                           | Type of study                  | Population                                      | Factors enhance adherence                                      |
|------------------------|------|------------------------------------------------------------------|---------------------------------|-------------------------------------------------|---------------------------------------------------------------|
| Kosobucka et al.       | 2018 | Dovepress                                                       | Observational cohort clinical study | 221 patients with ACDS | Age previous MI                                                  |
| Santo et al.           | 2018 | International Journal of Behavioral Nutrition and Physical Activity | Randomized clinical trial      | 705 patients with coronary heart disease        | Lifestyle-focused text-message program                        |
| Lee et al.             | 2018 | Health Quality Life Reviews                                     | Cross-sectional study           | 417 post-AMI patients with acute myocardial infarction | Early detection of patients with poor adherence to medication |
| Seid et al.            | 2019 | PLoS One                                                        | Cross-sectional study           | 510 adult heart failure patients                | Male in gender, No chronic comorbidity, Good level of heart failure, Knowledge |
| Metwaly and Zatton     | 2020 | Egyptian Journal of Health Care                                  | Pre/posttest quasi-experimental design | 35 adult patients | Health educational program                                      |
| Chew et al.            | 2021 | International Journal of Nursing Studies                        | A two-arm randomized controlled trial | 144 patients with heart failure | Self-care intervention                                          |
| Suhail et al.          | 2021 | Health Quality Life Outcomes                                     | Cross-sectional study           | 251 patients with IHD                          | Adequate health literacy                                       |

### Table 3. Reviews, systematic reviews, & meta-analyses that integrated treatment adherence for lifestyle recommendations included in this review

| Lead author            | Year | Journal of publication                                           | Type of study                  | Number of subjects/studies | Factors enhance adherence |
|------------------------|------|------------------------------------------------------------------|---------------------------------|-----------------------------|---------------------------|
| Tierney et al.         | 2012 | Heart Failure Reviews                                           | A systematic review of controlled studies | 3,231 patients             | Exercise prescriptions Goal setting Feedback Problem-solving Self-efficacy |
| Murray et al.          | 2012 | BMC Cardiovascular Disorders                                     | A systematic narrative review of quantitative observational studies | 32 studies (374 factors) | Support from family & friends Transport & other costs Beliefs about the causes of illness & lifestyle change |
| Oosterom-Calò et al.   | 2012 | Heart Failure Review                                            | A systematic literature review & meta-analysis | 569 studies                | Institutionalized patients in the past                          |
| Pfaefli Dale et al.    | 2016 | European Journal of Preventive Cardiology                       | A comprehensive literature search | 7 studies                  | 5 studies were effective at improving adherence to medication. 2 studies increased physical activity behavior. Simple text messaging interventions appeared to be most effective. |
| Unverzaght et al.      | 2016 | Deutsches Ärzteblatt International                               | Systematic review               | 42 trials (211 full text articles)             | Patients’ assuming responsibility for their own health Patient education Regular follow-up contacts |
| Leung et al.           | 2017 | International Journal of Environmental Research and Public Health | Literature review              | 19 studies                  | Attrition is the most common indicator used, followed by attendance, self-monitoring, and dietary adherence. Factors that may predict better adherence were being in action or maintenance stage of change, older age, higher education, healthier eating, and PA behavior at baseline and more initial weight loss. |
| Stonerock and Blumenthal | 2017 | Progress in Cardiovascular Diseases                             | Review                         | -                           | Motivational interviewing Trans theoretical model approaches |
| Kassavou and Sutton    | 2018 | Health Psychology Review                                        | Meta-analysis                   | 17 randomized controlled trials (38,671 participants) | Behavioral change techniques (BCTs) ‘tailored’ and ‘information about health consequences’ |
| Deon et al.            | 2019 | Diabetes & Metabolic Syndrome: Clinical Research & Reviews      | Systematic review              | 24 studies                  | Mobile health applications and self-monitoring |
Table 3 (continued). Reviews, systematic reviews, & meta-analyses that integrated treatment adherence for lifestyle recommendations included in this review

| Lead author         | Year | Journal of publication      | Type of study                      | Number of subjects/studies | Factors enhance adherence                   |
|---------------------|------|------------------------------|-----------------------------------|----------------------------|---------------------------------------------|
| Rashidi et al.      | 2020 | International Journal of Nursing Studies | Systematic review & qualitative synthesis | 22 articles               | Exercise Support Mentorship                 |
| Westland et al.     | 2020 | European Heart Journal       | Systematic review                  | 166 full-text articles on CAD studies | Cell phones, smartphones, personal computers, and wearables coupled with technologies such as the Internet, SMS, software applications, and mobile sensors |
| Akinosun et al.     | 2021 | JMIR Mhealth Uhealth         | Systematic review & meta-analysis  |                           | Digital interventions                       |

DISCUSSION

Understanding the circumstances and context that lead to unhealthy behaviors is challenging. Healthcare professionals are required to collaborate with each other, as well as with patients and their friends and family in order to develop and implement a treatment plan tailored to each patient’s specific needs. During the past decade, numerous studies were conducted looking into the effectiveness of interventions aimed to increase adherence of cardiovascular patients to lifestyle modifications. Their results underscore the value of establishing a treatment bond between the physician and the patient. A good therapeutic rapport is predictive of adherence to treatment and it is enhanced through trust, an individualized approach and the potential for instant consult in case of emergency. Patients who feel that they are being heard are also good listeners. Various interventions, including enrolling patients in cardiac rehabilitation programs, may be greatly beneficial, as they incorporate supervision from a multidisciplinary team and enhanced guidance. Moreover, a patient-tailored approach with behavioral interventions promotes a successful therapeutic adherence. Several studies have also proven the importance of early recognition of resistance to treatment, mainly in patients with a history of unhealthy habits, previous failed attempts to change, living alone or facing additional health issues. Patient readiness to change and to adopt new habits has not been adequately investigated, although it seems to affect adherence prognosis (Mckenna, 1996; Rich et al., 2015). Transtheoretical model (TM) is an integrative theory of therapy that assesses an individual’s readiness to act on a new healthier behavior, and provides strategies, or processes of change to guide the individual (Prochaska & DiClemente, 2005). TM posits that individuals move through six stages of change: precontemplation, contemplation, preparation, action, maintenance, and termination. The implementation of this model for detecting readiness to change, especially in patients prone to treatment dropout, as well as for the support of this changing process step-by-step, may offer a valuable tool to health educators.

Additionally, providing information through educational programs for patients and family members may set aside false beliefs and reestablish the control people have over their health, acknowledging that their behavior contributes both to health and disease. According to the social cognitive theory of health belief model (HBM), developed in order to understand failure to adopt disease prevention strategies, people will respond with positive changes if they recognize and understand that poor health may be avoided or prevented, and if they believe that they are able to adopt a new and beneficial behavior (Janz and Becker, 1984). Therefore, patient education and awareness campaigns will help increase understanding of therapeutic recommendations, as a prerequisite for improving health. Increased awareness regarding the disease and the way behavior affects health is important but not sufficient for change per se. Frequently, patients struggle to give up harmful habits despite being aware of their adverse impact or neglect to exercise despite knowing the benefits. Patients often require something more than plain instructions; instead, they need experiential education on new behavioral patterns before changing their lifestyle (Kolb and Kolb, 2009; O’Grady et al., 2008). A step-by-step educational process implemented by experts on how to abstain from a negative habit and how to replace it with a more beneficial one is of utmost importance. Educational interventions focused on increasing self-efficacy and self-care have been proven very effective in enhancing self-confidence, preserving functionality and maintaining patients’ mental health. Regular reminders, phone calls, text messages and notifications indicate interest and greatly contribute to maintaining a good therapeutic attitude over time, especially in the elderly and people with memory issues.

Patients receiving psychotherapy (Wallert et al., 2018) or those using stress management techniques (Yu et al., 2010) are less likely to regress to previous behaviors regarding adherence to recommendations, and exhibit less distress and anxiety. Family members and friends play a very important role in the course of the patient’s adherence to treatment; that said, people living alone or lacking a supportive network should be encouraged to seek help from organizations supporting patients with chronic diseases. Group therapies are highly beneficial for patients that struggle to discontinue unhealthy habits and need support by people experiencing similar feelings. Promoting feelings of social acceptance and providing support by organizations and family members significantly improve the emotional status of patients.

Despite the interesting findings regarding factors affecting adherence to treatment, studies included in this review have certain limitations. Measurement of adherence to treatment is typically performed using self-administered questionnaires; therefore, these studies are prone to social desirability bias. In
addition, most studies do not take into account cultural factors that may affect adherence; participant characteristics also exhibit great heterogeneity.

As the aim of the present review is to identify interventions facilitating adherence to treatment and not to list factors predicting non-adherence, there is a risk for selection bias. Finally, there are other studies with the same objectives that were not included, as they did not exclusively focus on patients with cardiovascular disease, but involved various chronic conditions. Many interventions effectively increase adherence to treatment for a specific group of patients may be beneficial for people with a different chronic disease; this warrants further investigation.

Future studies should focus on the effectiveness of various psychosocial models for behavioral change, in order to further analyze processes contributing to readiness for change and long-term maintenance of this behavior change. Furthermore, as the number of younger patients suffering from cardiovascular disease has risen in the recent years, it is important for future studies to identify variations in factors affecting adherence in different age groups. Finally, attention should be drawn in developing and administering more objective outcome measures for adherence to non-pharmaceutical recommendations.

In conclusion, health policy makers should take into account factors affecting change of behavior and invest in studying and developing flexible and cost-effective interventions encouraging adoption and long-term maintenance of a healthy lifestyle.

**IMPLICATIONS IN ENVIROMENTAL AND PUBLIC HEALTH**

The lack of adherence to non-pharmaceutical recommendations is a serious issue for cardiovascular patients worldwide, leading to hospitalizations, poor quality of life, and increased risk for clinical events and death. In addition, it undermines the effectiveness of health care systems and increases annual costs. The literature indicates that all these concerns may be avoided by investing in cost-effective interventions that promote patient adherence to treatment. The recognition of factors affecting lifestyle modifications of cardiovascular patients increases the chances of adopting positive health behaviors and has extended applications for the health education field. Health professionals and educators can contribute to treatment adherence in the following ways:

1. design of educational programs based on experiential learning for health professionals,
2. compassion cultivation training programs for health providers and for the patient’s relatives,
3. inclusion of theoretical models of behavior change from social sciences in the training of specialists and patients (Educational programs should focus on influence attitudes, beliefs, and in the timely acceptance of disease and its preparation for change),
4. working with social health agencies to support the vulnerable population,
5. promotion of enhanced cardiac rehabilitation programs,
6. patient education in the use of technologies, apps as motivation reminders, and organize treatment goals,
7. promote collective actions and awareness strategies in cardiovascular health,
8. creating campaigns that promote the adoption of a healthy lifestyle behaviors with inspiring role models,
9. collaboration with experts to study and evaluation of the reported actions, and
10. conduct research related to patients’ satisfaction from his therapy, health practitioners, and support service providers.

We recommend health professionals use our findings to enhance therapeutic process with effective interventions and help create a flexible treatment framework where the patient receives individualized support at all stages of the change.

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