

# Association Between Different Types of Social Support and Medication Adherence

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**N**onadherence to chronic medications imposes a substantial clinical and financial burden on the US healthcare system. Studies have repeatedly demonstrated that medication nonadherence is a common source of hospitalizations, morbidity, and mortality in a variety of populations and disease states.<sup>1-3</sup> The financial consequences of medication nonadherence in the United States are tremendous; the cost of care for patients with cardiovascular disease and diabetes are substantially greater in those who do not adhere to therapy than in those who do adhere, and total annual costs of medication nonadherence are estimated at almost \$300 billion in the United States.<sup>3,4</sup>

Despite the importance of medication nonadherence, no simple solutions are available to fix the problem.<sup>5</sup> Numerous studies have aimed to improve medication adherence, yet best practices to enhance better medication taking continue to evolve.<sup>4,6</sup> Moreover, little is known about the most cost-effective interventions to encourage better adherence.<sup>7</sup> Therefore, new, low-cost approaches to improve medication adherence are needed to promote improved health outcomes and reduce healthcare costs.

The emergence of popular online social networking websites has stimulated interest in the role of social capital or connectedness in promoting health. Greater social support has been shown to be associated with improved health outcomes and healthier behavior.<sup>8</sup> Yet the role of one's social connectedness in medication adherence has not been well defined. Considering that social support connections are wide ranging, encompassing many aspects of the relationship between the patient and the person providing the support, we know even less about how different features of one's social support system can influence medication use.

Accordingly, we conducted a systematic review of the published literature to evaluate what is known about the association between social support and medication adherence in a variety of disease states, and to explore features of one's social support that might encourage better behavior. To do so, we categorized social support structures into those that are more functional and those that are predominantly emotional in nature.<sup>9,10</sup> We aimed to evaluate the relative influence of the various

types of support on medication adherence, so that appropriate and effective interventions to improve medication adherence can be designed.

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**Objectives:** To evaluate the association between social support and medication adherence.

**Study Design:** A search of articles published before November 2010 in peer-reviewed, healthcare-related journals was conducted using PubMed, EMBASE, and Web of Science, and search terms related to social support (*social support OR friend OR family OR agency*) and adherence (*patient compliance OR medication adherence*), yielding 5331 articles.

**Methods:** Articles were included if they directly measured the relationship between medication adherence and some form of social support. Excluded were case studies, studies with participants <18 years of age, and non-English language studies. Four social support categories were reported: structural, practical, emotional, and combination. Medication adherence was reported in the manner in which it was described in each study.

**Results:** Fifty studies were included in the final analysis. A greater degree of practical support was most consistently associated with greater adherence to medication; evidence for structural or emotional support was less compelling. However, most studies were limited in size and design, and substantial variability in designs and outcome measurement prohibited pooling of results, necessitating qualitative evaluation of the studies.

**Conclusions:** This qualitative analysis found that practical social support was most consistently associated with greater medication adherence. Interventions that use existing contacts (friends or family) to engage patients in the mundane and practical aspects of medication purchasing and administration may be an effective approach to promoting better medication adherence.

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### Take-Away Points

This qualitative analysis found that practical social support is consistently associated with higher medication adherence.

- Medication adherence is most closely associated with having a repertoire of close friends or providers who can consistently provide emotional and practical support that does not leave the patient with the perception of unmet needs.
- Providing people in the patient's social network with emotional and practical skills (eg, focused on medication adherence, barriers, support, and confidence building) may have a significant impact on medication adherence.

social support item abstracted from an included study was placed into 1 of these 4 social support categories by 2 reviewers independently, and disagreements were resolved by a third reviewer. The combination category reflects those social support items or instruments that did not distinguish the precise type of support measured, or that only reported a summary measure that included multiple support types.

Our outcome variable, medication adherence, is reported in the manner it was described in each study ([Appendix](#)). Studies that reported more than 1 social support category are represented in more than 1 table in the [Appendix](#).

## METHODS

### Study Selection

With the help of a professional librarian, we performed a search of articles published before November 2010 in peer-reviewed, healthcare-related journals using PubMed, EMBASE, and Web of Science. We used search terms related to social support (*social support OR friend OR family OR agency*) and adherence (*patient compliance OR medication adherence*). Articles with at least 1 search term from both categories met the criteria for the initial title/abstract review. After screening for duplicate entries, the results from the 3 databases were combined and totaled 5331 articles. Of these abstracts, 169 were included for full review of inclusion and exclusion criteria ([Figure](#)).

Articles were included if they directly measured the relationship between medication adherence and some form of social connectedness and/or support. There were 131 excluded articles, including case studies, studies with patients less than 18 years of age, non-English language publications, and studies where no medication-specific adherence measure was reported as an outcome (leaving 38 articles). Pediatric studies were excluded because the different mechanism and influence of social support in pediatric versus adult medication adherence would make conclusions difficult. The inclusion or exclusion of each article was determined by 2 reviewers independently, and disagreements were resolved by a third reviewer. All reference lists from the included articles were evaluated, and 12 additional studies (not found in our original search) were included, as determined by consensus. Data on study populations and characteristics, results, and study quality were extracted from each article using a standardized protocol and reporting form. Specific information collected included study population, social support measure, adherence measure, and adherence outcome.

### Data Extraction

For our key explanatory variable, social support, we defined 4 categories: structural, practical, emotional, and combination, which are further defined with examples in the [Table](#). Each

## RESULTS

### Population

We included a total of 50 studies; 14 evaluated structural support, 12 practical support, 14 emotional support, and 26 combination support ([Figure](#)). Most were conducted in disease-specific populations; the most common were human immunodeficiency virus infection/acquired immunodeficiency syndrome (HIV/AIDS), diabetes, dialysis, tuberculosis, cardiovascular (hypertension and congestive heart failure), asthma, and transplant. Most were cross-sectional observational studies. Sample sizes ranged from 26 to 1198 patients.

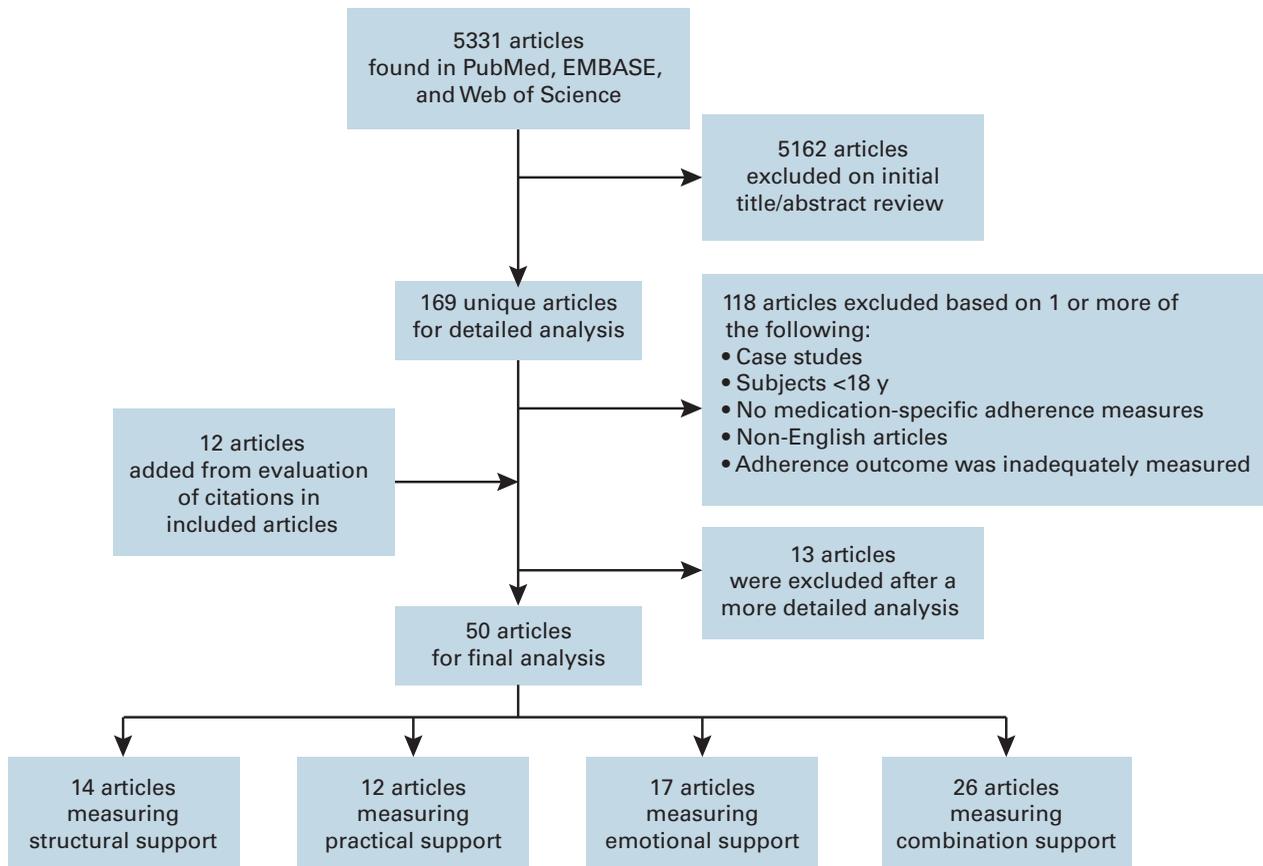
### Social Support Measurements

Almost all included studies required participants to evaluate their perception of support; 2 interviewed caregivers.<sup>11,12</sup> Approximately half used some variation of a previously validated instrument, and half used study-specific questionnaires. A majority utilized a self-completed survey instrument ( $n = 28$ ), while fewer relied on interviews ( $n = 16$ ). The remainder utilized a combination of surveys and interviews, or did not describe the data collection. Most included several different types of support, while 17 measured only 1 type. Adherence was largely measured using subjective self-report, while 13 corroborated adherence objectively with pill count, refill information, or urine/serum markers of adherence.<sup>1,2,13-23</sup> One study used a nurse assessment of adherence.<sup>24</sup>

### Structural Support

We identified 14 studies that assessed the relationship between structural social support and medication adherence; this structural support was cohabitation in 4 studies,<sup>1,20,24,25</sup> presence of a spouse or supportive relationship in 7 studies,<sup>22,26-31</sup> and

■ **Figure.** Article Inclusion Algorithm



both in 2 studies.<sup>14,32</sup> In 1 study, structural social support was defined by the size of patients' social network (Table).<sup>9</sup>

Of all these studies, 6 (43%) identified an association between structural support and medication adherence, but some identified a positive association and others found a negative association. Two identified relationship status as significantly associated with being more adherent, with logistic regression coefficients of 1.2 (*P* value not reported)<sup>26</sup> and 2.7 (*P* = .02)<sup>32</sup>; however, a third study identified having a partner as being associated with lower odds of adherence compared with not having a partner (odds ratio [OR] of adherence 0.97, *P* < .01),<sup>28</sup> and a fourth study found that adherence was highest in divorced persons.<sup>29</sup> Living situation (eg, living with someone) had a negative association with adherence in 2 studies (both in an HIV population).<sup>24,32</sup> Only 1 study found that living with a spouse or relative had a significant, but modest, association with adherence.<sup>20</sup>

Of the 8 (57%) studies that did not identify an association between structural support and medication adherence,<sup>1,9,14,22,25,27,30,31</sup> most evaluated marital status or living status. Two of these studies involved large cohorts of patients

with objectively measured medication adherence.<sup>22,30</sup> The 1 study that evaluated social network size did not identify a significant association with adherence, although it evaluated only frequency of contact, but not quality or type of the interaction.<sup>9</sup>

### Practical Support

We identified 12 studies that assessed the relationship between practical social support and medication adherence. Practical support was assessed by subjective participant ratings about how much help they received or how satisfied they were with the help in 3 main areas: medication help (reminders to take medication, directive guidance on medications, picking up prescriptions), help with household functions (cooking, cleaning, paying bills, running errands), and help with transportation.

Of these 12 studies, 8 (67%) identified a significant association of help with adherence. Of those, all but 1 identified a significant positive association (either amount of support or satisfaction with support) with medication adherence.<sup>11,19,33-37</sup> The 1 study that identified a negative as-

■ **Table.** Types of Social Support

Type of Support	Examples
Structural	Marital status Living arrangement Social network size
Functional: practical/instrumental	Paying for medications Picking up prescriptions Reading labels Filling pill boxes Transportation Physical assistance
Functional: emotional	Encouragement Listening Attachment Nourishment Reassurance of worth Modeling Informational support (of the benefit of adherence and risk of nonadherence) Spiritual support

sociation was a small study with an HIV cohort, where the adherence measure was nurse-perceived adherence, a poorly validated measure of actual medication use.<sup>24</sup> Two studies analyzed the association using a multivariate technique. The first study found the number of sources of practical support was associated with adherence; having 1 source of support was not associated with higher adherence, but 2 or more sources were associated with twice the odds of adherence compared with the adherence of patients with no sources of support (OR of adherence 2.12, 95% confidence interval [CI] 1.06-4.26;  $P = .004$ ).<sup>36</sup> In the second study, participants who had an “unmet need” for benefits (eg, Medicaid, Social Security, or prescription help) had an OR of nonadherence of 2.8 ( $P < .01$ ) compared with patients who did not have this unmet need; 51% of the cohort reported needing help in this area. Other unmet practical needs were not associated with adherence (housing, emergency provisions, legal assistance, or supplemental nutrition), although about two-thirds of the cohort did not report a need in those areas.<sup>37</sup>

Of the 4 (33%) studies that did not identify an association, all were limited by very small sample sizes (58-112 patients), and subjective self-reports of both practical support and medication adherence.<sup>12,38-40</sup>

### Emotional Support

**Observational Studies.** We identified 14 observational studies that assessed the relationship between emotional support and medication adherence. Emotional support was assessed by self-report in a variety of ways, including perceived

amount of or satisfaction with social support, number of social support unmet needs, or the number of friends and social support sources.

Of these studies, 6 (42%) identified a significant association between any emotional support measure and adherence. Five found a positive association between emotional support and adherence, and 1 found a mixed association between support and adherence, with a negative association between social attachment and short-term (3-day) medication adherence (OR 0.49, 95% CI 0.34-0.71;  $P < .01$ ), and a positive association between higher reassurance of worth and longer term (30-day) medication adherence (OR 1.3, 95% CI 1.03-1.6;  $P < .05$ ).<sup>41</sup> Of the 5 that found a positive association, 2 found a univariate association between medication adherence and emotional support in small samples of HIV patients.<sup>34,42</sup> Another small study of renal transplant patients found affectionate support explained 12% of the variance in adherence in multivariable regression.<sup>33</sup>

A large sample of HIV patients identified as having the unmet need of counseling had significantly reduced odds of being adherent (OR 0.32;  $P < .01$ ), and having the unmet need of a support group significantly increased the odds of not taking medications (OR 3;  $P < .05$ ).<sup>37</sup> In 1 large cohort of patients on lipid-lowering medications, the larger the number of close friends, the lower the chance of being nonadherent, with 16% nonadherence in those with no close friends and 7% nonadherence in those with 3 or more close friends ( $P = .04$  for trend). The frequency of contact also correlated with adherence, although it did not reach statistical significance (16% nonadherence in those with less than weekly contact vs 8% nonadherence in those with at least weekly contact;  $P = .09$ ).<sup>43</sup>

Most of the 8 (58%) studies that did not identify an association were limited by small sample sizes (26-136 patients) with subjective self-reports of both emotional support and medication adherence.<sup>11,19,24,35,39,44,45</sup> One large cohort study that did not identify a statistical association is worth mentioning. This study of 262 patients with postacute coronary syndrome found that the number of sources of support did increase the odds of adherence (compared with no sources, those with 1 source had an OR of adherence of 1.2, and those with 2+ sources of support had an OR of 1.4), although this difference did not reach statistical significance.<sup>36</sup>

**Interventional Studies.** We identified 3 interventional studies that randomized patients to receive emotional support and evaluated the effect on medication adherence. All 3 studies focused on HIV patients (sample sizes ranging from 136 to 215). One found no effect of a peer support group (6

bimonthly group meetings and weekly phone calls) on HIV medication adherence.<sup>45</sup> Another study revealed that cognitive-behavioral stress management expressive-supportive therapy (10 weekly sessions) also had no overall effect on medication adherence.<sup>46</sup> However, the last study reported that engaging a patient and their HIV-serodiscordant partner in four 1-hour educational sessions (focused on medication adherence, barriers, support, and confidence building) significantly increased the percentage of patients who achieved at least 95% adherence with their HIV regimen (35% in the intervention group and 19% in the control group,  $P = .02$ ).<sup>47</sup>

### Combination Support

We identified 26 studies that assessed the relationship between a combined support measure and medication adherence. Combined support was assessed by self-report in a variety of ways, including perceived amount of or perceived satisfaction with emotional and practical support, or the presence (or absence) of any support.

Of these studies, 13 (50%) revealed a significant association between support and medication adherence. Seven studies evaluated only univariate associations with very small sample sizes (50-144 patients), making firm conclusions difficult.<sup>17,18,34,48-51</sup> Of the remaining 6 studies, 1 revealed that adherence was *lower* with more support (this study was mentioned in the Emotional Support sections).<sup>41</sup> One small cohort of renal transplant patients found that combination support explained 24% of the variance in adherence in a multivariable regression model,<sup>33</sup> and a study with a small cohort of heart failure patients found that higher perceived support significantly predicted fewer missed medications doses (multivariable regression  $\beta -0.241$ ,  $P = .14$ ). The remaining 3 studies with HIV cohorts found that more social support was associated with greater adherence and fewer missed doses; one of the studies specifically found twice the odds of adherence in those with support versus those without support.<sup>23,52,53</sup>

Most of the 13 (50%) studies that did not identify an association were limited by small sample sizes (30-116 patients) with subjective self-reports of support and medication adherence.<sup>15,16,21,27,31,39,54-58</sup> However, 2 notable large-cohort studies are worthy of mention. The first evaluated 1141 post-myocardial infarction patients followed for 2 years; the researchers identified no significant association between social support, social networks, or social activities and adherence to antiarrhythmic medications, although they dichotomized medication adherence into “adherent” and “nonadherent” and 78% of the group was adherent, making statistical distinctions between the groups difficult.<sup>22</sup> The other study involved a large cohort of 496 hypertensive patients who assessed (on a 4-point scale) whether friends or family attempted to help them take

their hypertension medications properly. The study did not report the mean amount of support, so it is not clear whether the study population’s support level was diverse enough to detect an association between support and adherence.<sup>13</sup>

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## DISCUSSION AND CONCLUSIONS

Medication nonadherence is a burden to the United States healthcare system, resulting in higher healthcare costs and poorer patient outcomes. This analysis assessed the direction and strength of the association between social support and medication adherence, and categorized social relationships into structural, practical, emotional, and combined support. We found, qualitatively, that greater practical support of medication taking was most consistently associated with greater adherence to therapy.

Structural support, as defined by cohabitation or support from a spouse/significant other, was not consistently associated with medication adherence. This implies that the mere presence of a spouse/partner is not sufficient to affect behavior. Similarly, fewer than half of the studies we found demonstrated a relationship between emotional support and adherence. Emotional support was found to correlate best with adherence when it involved meeting unmet needs or having close friends. The interventional studies did not find that emotional support by peer or specialty providers had a significant effect on medication adherence. However, 1 interventional study did find engaging and empowering an emotionally invested partner did improve medication adherence, at least in HIV care.

On the other hand, practical support—as defined by the number of sources (or satisfaction with the sources) of practical support for medication reminders, household responsibilities, or transportation—was consistently associated with improved medication adherence. Improved medication-taking behavior was most closely associated with assistance in the very process of purchasing or administration of therapy. The one study that evaluated practical support using multivariate techniques found a dose-response relationship; an increased number of sources of practical support was associated with increased adherence.<sup>36</sup> This result may imply that redundancy in the support network may be vital to ensure overall consistency in receipt of support.

Findings from the analysis of combination support were mixed, but were limited by small sample sizes, primarily univariate analysis techniques, and heterogeneity in the definition of support.

Despite the low cost and intuitive appeal of interventions utilizing social contacts to promote better adherence, little prospective evidence exists to understand the effectiveness of this approach. The observational design of the majority of the studies in our review limits our ability to assess causation. It

is possible that patients who receive meaningful support from family or friends when purchasing or administering medication differ in other important ways from those who do not. Moreover, most of the studies assessing emotional or combination support were limited in size and design, leading to difficulty in drawing firm conclusions about the nature and magnitude of the relationships identified. There was variability in the methods of collecting both the explanatory and outcome variables in the studies we analyzed. Due to this variability, we were unable to pool results across studies and conducted a qualitative review of the literature. While specific types of social support were associated with varying levels of adherence, the strength of the effect of each type has not been clearly quantified.<sup>9,10</sup> As a result, this review does not provide a quantitative assessment of a specific hypothesis, but rather synthesizes a complex literature and assesses the evidence to date regarding the relationship between social connectedness and medication adherence.

Despite these limitations, our review does suggest that practical aspects of medication taking may be the most fertile locus for interventions in future studies. Using existing contacts (friends or family) to engage patients in the mundane and practical aspects of medication purchasing and administration may be an effective approach to promoting better medication adherence. Such an approach could be low cost and could leverage existing relationships to encourage better chronic disease management. Future studies should evaluate the feasibility and efficacy of assigning family or friends to provide this level of support to patients. Additionally, studies are needed to assess the efficacy of increasing the “bandwidth” or redundancy of a support network, or arming other members of the social network with the emotional and practical skills needed to enhance medication adherence. As more Americans use online social networks to garner emotional support and to answer specific questions about the management of chronic disease, explicit study of how to promote medication adherence by engaging willing patients in these networks also is needed.

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**Appendix.** Evidence Tables of All Included Studies

<b>STRUCTURAL STUDIES</b>					
<b>Author/Year</b>	<b>Disease/No.</b>	<b>Social Support Measure</b>	<b>Adherence Measure</b>	<b>Adherence Outcome</b>	<b>Limitations</b>
Botelho RJ 1992	Elderly patients with 2 or more chronic diseases (unspecified)  N = 59	Interview  Living alone or with others—yes or no	Pill count: (number pills in bottle)/(number pills should be in bottle)*100  Adherent >80%  Adherent 45%	No significant association	Sample size
Coons SJ 1994	Patients age 55 y or older (unspecified)  N = 785	Interview  Living with others—yes or no  66% lived alone	Self-reported adherence in last month (noncompliant was taking meds more or less than prescribed)  79% adherent	No significant association	
De Geest S 1995	renal transplant  N = 148	Interview  Marital status—married or unmarried  78% married	Self-reported adherence in last 12 mo (noncompliant was having skipped medication on a regular basis)  Content of interviews was assessed by PI to determine nonadherence  78% adherent	Significantly more unmarried in nonadherent group (36% of nonadherent group) than in adherent group (18% of adherent group) ( $P = .03$ )  Marital status $\beta = 1.2394$ ( $P$ value not reported)	
Diehl AK 1987	DM (non-insulin dependent)  N = 77	Interview  marital status—married or unmarried; living with others—yes or no  53% married  18 % lived alone	Pill counts and insulin weighings over 24 wk  adherent >80%  81% adherent	No significant association	Sample size
Evangelista LS 2001	Heart failure  N = 82	Self-completed questionnaire and interview  Marital status—married or	Self-reported compliance on 5 point scale; 0 = none of the time to 4 = all the time—scores	No significant association	Sample size  Almost all adherent

		unmarried  67% married	converted 0-100  Mean medication compliance score: 96.65		
Gibbie T 2007	HIV  N = 80  Control group: HIV negative N = 20	Interview and self-report  Living with others—yes or no  Relationship status (single or in relationship)  37% lived alone 63% lived with others  54% single 46% in a relationship	Self-reported adherence in: past 1 day, 4 days and 7 days  Adherent >95%  4% nonadherent in past 1 day 17% nonadherent in past 4 days 31% nonadherent in past 7 days	logistic regression predicting 7-day adherence  Living situation $\beta = -2.433$ ( $P=.04$ )  Relationship status $\beta = 2.695$ ( $P = .02$ )	Sample size
Irvine J 1999	Myocardial infarction and ventricular ectopy  N = 671	Self-completed questionnaire  Marital status—married or unmarried  75% married	Pill count mean over 2 y Adherent >66% Nonadherent <66%  22% nonadherent	No significant association	
Lorenc L 1993	Antibiotics or chronic illness  N = 149  3 groups: Group 1 age 25-35 y (antibiotic group) or age 45-55 y (chronic illness group)  Group 2 age >70 y and living alone  Group 3 age > 70 y and living with relative or spouse	Self-completed questionnaire  Living with others—yes or no	Pill count  Compliance ratio (CR) = [number tablets taken/number should have taken]*100  Adherent: CR between 90 and 110  Adherent (antibiotic) 44% (young age), 36% (old living alone), 72% (old living with others)  Adherent (chronic illness) 54% (young age), 60% (old living alone), 68% (old living with others)	Living with spouse or relative was significantly and independently related to compliance, $P < .001$	

Molloy GJ 2008	Acute coronary syndrome  N = 193	Self-completed questionnaire  Frequency of social interaction with 12 sets of contacts (values of 0-12; higher values representing more extensive social networks)  Scores trichotomized: Small (<4), Medium (4-5) Large (>5)  Mean score: 4.85  25% small network 40% medium network 35% large network	Telephone interview at 12 mo after hospital admission  3 yes/no questions relating to adherence  Poor adherence: having any problems with medication as identified by 3 questions  56% adherent	No significant association	
Morse EV 1991	HIV  N = 40	Self-completed questionnaire  Living with others—yes or no  29% lived alone	Qualitative nurse rating of all subjects from most to least adherent	T score for living with others (vs alone) on adherence: -3.01 ( $P < .01$ )	Sample size
Murphy DA 2002	HIV  N = 46	Interview  Partner status— yes or no  67% partner	4 dichotomous measures: Dose adherent past 3 days (self- report) Schedule adherent past 3 days (self- report); Dose adherent past week (self- report) Pill count  Adherent >95%  Dose adherent past 3 days 56% Schedule adherent past 3 days 50% Dose adherent past week 50% Pill count	Having a partner vs no partner was not related to medication adherence in 3 of 4 measured and negatively associated in the fourth (OR 0.097, $P < .01$ )	Sample size

			adherent 43%		
O'Brien ME 1980	Hemodialysis  N = 63	Interview  marital status (never married, married, widowed, divorced or separated)  49% married 51% unmarried (never, widowed, divorced, or separated)	Self-report 7 items, each on 0-3 Likert scale (3 = always 2 = usually 1 = sometimes 0 = never) Scores summated 21 = highest adherence  Mean adherent score: 13.2 (SD 3.5)	Mean adherence scores: never married: 10.3 married: 13.8 widowed: 14.5 divorced 15.9 separated: 12.1 <i>P</i> < .01 for trend	Sample size
Treadaway K 2009	Multiple Sclerosis  N = 798	Self-completed questionnaire  Marital status (married, single, divorced or widowed)  72% married 14% single 13% divorced 1% widowed	Self-reported adherence in past 4 weeks  Nonadherent: missing any injection in past 4 wk  Adherent 61%- 64%	No significant association	
Trehanre GJ 2004	Rheumatoid arthritis  N = 85	Self-completed questionnaire  Marital status (single, married, living with a partner, in a partnership but not living together, divorced, widowed)	Questionnaire 19 items, each 4- point Likert scale 2 items, each 5- point Likert scale  94% rarely or never forget 91% rarely or never miss/adjust a dose	No significant association	

#### PRACTICAL STUDIES

Author/Year	Disease/No.	Social Support Measure	Adherence Measure	Adherence Outcome	Limitations
Baiardini I 2006	Asthma  N = 63	Self-completed questionnaire  Extent of family/friend help in illness management (3-point scale: not at all/a little; enough; much/very much)	Adherence Schedule in Asthma Questionnaire  Taking medicines correctly (3-point scale: not at all/a little; enough; much/very much)	No significant association	Sample size

		Not at all/a little: 35% Enough: 35% Much/very much: 30%	Not at all/a little: 25% Enough: 35% Much/very much: 40%		
Beals KP 2006	HIV  N = 112	Interview  Extent to which they remind to take meds (1 = never, 4 = very often) Mean 2.5 (SD 1.2)  How often they picked up meds in past 2-3 weeks (1 = none, 4 = all) Mean 1.8 (SD 1.1)	Self-reported over past 4 wk  4 items—each ranged from 1 = never to 4 = all the time  Responses dichotomized 1 = perfectly adherent (4 on all items) 0 = anything less than perfect adherence  37% perfect adherence	No significant association	
Chisholm-Burns MA 2010	Renal transplant  N = 61	Self-completed questionnaire  Survey instrument: Social Support Survey-5 two items, each on 5-point Likert scale (practical support in daily household functions and transportation issues) (higher more support)	Immunosuppressant Therapy Adherence Scale 4 items, each on 4-point scale (0-3, higher is more adherent)  Mean: 11.1 (SD 2)	Significant univariate association between instrumental support–household functions and adherence (correlation $r = 0.34$ , $P < .05$ )  No significant association between instrumental support-transportation issues	Sample size
Garcia JIR 2006	Schizophrenia  N = 30	Qualitative interviews with caregivers score range 0-20  Quantified “task-oriented” assistance  Mean instrumental support: 8.2 (SD 5.4)	“Regular” or “irregular” based on >75% or <75% estimate by clinical caretakers  43% regular 57% irregular	Significant univariate association between instrumental support and medication usage (correlation $r = 0.38$ , $P < .05$ )	Sample size

				OR regular (vs irregular) medication usage in those with higher instrumental support: 4.8 (95% CI 1.1-21.7, $P < .05$ )	
Gardenier D 2010	HIV N = 56	Self-completed questionnaire  Instrument: Social Provision Scale: 2 subscales for instrumental/practical support (higher more support)  Mean score: 47	AIDS Clinical Trial Group (ACTG) adherence follow-up instrument: Self-reported adherence < or > 95%  55% adherent 45% nonadherent	Mean practical support score significantly higher in adherent versus nonadherent groups, (49 vs 44, respectively, $P = .03$ )	Sample size
Hilbert GA 1985 (ANNA)	Hemodialysis N = 26	Self-completed questionnaire  Instrument: Social Support Questionnaire 8 items of “directive guidance” range 0-40 (higher more support)  Mean 27.3	Self-report adherence to medication rated 0 (none) to 4 (all the time)  Mean: 3.7	Significant univariate association between directive guidance support and adherence (correlation $r = .415$ , $P = .02$ )	Sample size
Hilbert GA 1989	Hemodialysis N = 58	Self-completed questionnaire  Instrument: Social Support Questionnaire: 10 items of directive guidance, each rated 1-5 (higher more support)  Mean 29.3 (SD 11.9)	Self-reported adherence to medication in previous week, rated 0 (none of the time) to 4 (all of the time)  Mean 3.5 (SD 0.9)	No significant association	Sample size
Molloy GJ 2008	Postacute coronary syndrome N = 262	Qualitative interviews of practical support and number of sources (0, 1, or 2)  30% had 0 16% had 1 54% had 2+	Qualitative interviews at 12 mo, dichotomized into “good” or “poor” adherence  50% good	OR adherence (reference of no practical support) 1 source of support: OR adherence of 1.04 (95% CI	

				0.42-2.57) 2+ sources of support: OR adherence 2.12 (95% CI 1.06-4.26, $P = .004$ )	
Morse EV 1991	HIV N = 40	Self-completed questionnaire  Perceived level of support provided by significant other to remind patient to follow MD/RN orders: not at all, some, a lot	Qualitative nurse rankings of all subjects from most to least adherent	T score for help in reminding and compliance: $-3.01 (P < .01)$	Sample size  Nurse-based assessment of adherence
Reif S 2006	HIV N = 526	Self-completed questionnaire  Unmet social support needs, assessed by 15 items in 7 categories (2 emotional and 5 practical support needs) Housing, emergency provisions (food/clothing), legal assistance, supplemental nutrition, benefits (Medicaid, Social Security, prescription help)  47% had at least 1 unmet need	Self-reported 1 item "in the past month, how much of the time did you take your medication as described" 5-point Likert scale  5 considered adherent, other 4 ranking considered nonadherent	OR nonadherence 2.76 ( $P < .01$ ) in those with unmet need of benefits (compared with those without unmet need)  No significant association with unmet needs of housing, emergency provisions, supplemental nutrition, or legal assistance	
Sayers SL 2008	Heart failure N = 74	Self-completed questionnaire  Instrument: Medical Care Questionnaire: 5 items relating to practical support Scale 0-5 (higher more support)  MSPSS assessing instrumental support	Self-report: 4-item measure of reasons for nonadherence (higher less adherent)	No significant association	Sample size
Singh N 1999	HIV N = 123	Self-completed questionnaire	Refill adherence Adherent: >90% refills at 6 mo	Significantly lower satisfaction	

		Instrument: social Support Questionnaire: satisfaction with practical support: 4-point scale (higher score is lower satisfaction with support)	Nonadherent: 90% refills 82% adherent 18% nonadherent	for practical support in nonadherent group  Mean practical support: 7.7 in nonadherent and 5.5 in adherent (p = .007)	
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EMOTIONAL STUDIES					
Author/Year	Disease/No.	Social Support Measure	Adherence Measure	Adherence Outcome	Limitations
Catz SL 2001	HIV  N = 113	Self-completed questionnaire  Instrument: Provisions of Social Relations Scale, 15 items, 2 subscales (support from friends and support from family) (higher more support)	7-day self-report  Adherent was no skipped doses in a week	No significant association	
Chisholm-Burns MA 2010	Renal transplant  N = 61 returned	Self-completed questionnaire  Instrument: Modified Social Support Survey-5 3 items, each on 5-point Likert scale (emotional support, affectionate support, and positive social interaction) in previous 4 wk (higher more support)  Item score range 1-5	Immunosuppressant Therapy Adherence Scale 4 items, each on 4-point scale (higher more adherent)  Mean score 11.1 (SD 2)	Significant univariate association between affectionate support and adherence (correlation $r = 0.3$ , $P < .05$ )  Affectionate support explained 12% of variance in adherence in multivariable regression  No significant association with emotional support or positive social interactions	Sample size
Garcia JIR	Schizophrenia	Qualitative	“Regular” or	No significant	Sample size

2006	N = 30	interviews, score range 0-6 (higher more support)  Mean emotional support 0.74 (SD 1.55)	“irregular” adherence based on >75% or <75% estimate by clinical caretakers  45% regular 55% irregular	association	
Gardenier D 2010	HIV  N = 56	Self-completed questionnaire  Instrument: Social Provisions Scale: 4 subscales for emotional support (higher more support)  Mean score 25	AIDS Clinical Trial Group (ACTG) adherence follow- up instrument: self- reported adherence <95% or >95%  55% adherent 45% nonadherent	Support score significantly higher in adherent vs nonadherent groups (26.4 vs 24.6, respectively, $P$ = .03)	Sample size
Hilbert 1989	Hemodialysis  N = 58	Self-completed questionnaire  Instrument: Social Support Questionnaire: 4 items of “affection”, each rated 1-5 (higher more support)  Mean 10.3 (SD 4.1)	Self-report adherence to medication in the previous week, rated 0 (none) to 4 (all the time)  Mean 3.5 (SD 0.9)	No significant association	Sample size
Hilbert 1985 ANNA	Hemodialysis  N = 26	Self-completed questionnaire  Instrument: Social Support Questionnaire: 4 items of “affection” (higher more support)  Mean 10.6	Self-report adherence to medication, rated 0 (none) to 4 (all the time)  Mean 3.7	No significant association	Sample size
Kaplan RC 2004	Lipid- lowering medications  N = 510	Interview  Number of close friends (0, 1-2, or 3+)  Contact with closest friend (weekly or	Self-reported adherence in last month, 0 = none, 4 = all the time (nonadherent was 0-2, adherent was 3-4)  88% adherent	Significant association between adherence and number of close friends: 0 close friends: 16% nonadherent	Sample size

		<weekly)	12% nonadherent	<p>1-2 close friends: 12% nonadherent</p> <p>3+ close friends: 7% nonadherent (<math>P = .04</math>)</p> <p>No significant association between adherence and contact with closest friend: &lt; weekly contacts: 16% nonadherent; weekly contact: 8% nonadherent (<math>P = .09</math>)</p>	
Molloy GJ 2008	<p>Postacute coronary syndrome</p> <p>N = 262</p>	<p>Qualitative interviews of emotional support and number of sources (0, 1, or 2)</p> <p>18% had 0 27% had 1 55% had 2+</p>	<p>Qualitative interviews at 12 mo, dichotomized into “good” or “poor” adherence</p> <p>50% good</p>	<p>No significant association</p> <p>OR adherence (reference of no emotional support)</p> <p>1 source of support: OR 1.2 (95% CI 0.5-2.9)</p> <p>2+ sources of support: OR 1.4 (95% CI 0.6-2.9)</p>	
Morse EV 1991	<p>HIV</p> <p>N = 40</p>	<p>Self-completed questionnaire</p> <p>Social support and emotional support each on scale 1-3</p> <p>Mean social support 2.1 (SD 0.7)</p> <p>Mean emotional support 2.4 (SD 0.7)</p>	<p>Qualitative nurse ratings of all subjects from most to least adherent</p>	<p>No significant association</p>	
Murphy DA 2004	<p>HIV</p> <p>N = 115</p>	<p>Interview Instrument: Social</p>	<p>Self-reported adherence &gt;95%</p>	<p>Multivariate regression:</p>	

		<p>Provisions Scale: 4 subscales for emotional support (higher more support)</p> <p>Mean scores of 4 subscales: Attachment 11.7 (SD 2.4) Nurturance 11.1 (SD 2.4) Reassurance of worth 12 (SD 2.2) Social integration 11.9 (SD 2.2)</p>	<p>Past 3 days: 58% Past week: 35% Past month: 26%</p>	<p>3-day adherence significantly lower with higher social attachment (OR 0.49, 95% CI 0.34-0.71, <math>P &lt; .01</math>) No significant association with nurturance, reassurance of worth, or social integration</p> <p>Past week adherence no significant association with emotional support subscales</p> <p>Past month adherence significantly higher with higher reassurance of worth (OR 1.3, 95% CI 1.03-1.6, <math>P &lt; .05</math>) No significant association with other emotional subscales</p>	
Reif S 2006	HIV N = 526	<p>Self-completed questionnaire</p> <p>“Unmet” social support needs, assessed by 15 items in 7 categories (2 emotional and 5 practical support needs)</p> <p>47% had at least 1 unmet need</p>	<p>Self-reported 1 item “In the past month, how much of the time did you take your medication as described?” 5-point Likert scale, 5 considered “adherent, other 4 rankings considered nonadherent</p>	<p>Having at least 1 unmet need was significantly associated with nonadherence (<math>P = .02</math>)</p> <p>Having the unmet need of counseling” significantly reduced the odds of being adherent (OR 0.32, <math>P &lt; .01</math>)</p> <p>Having the unmet need of a</p>	

				support group significantly increased the odds of taking no medication (OR 3, $P < .05$ )	
Servellen GV 2005	HIV N = 85	Self-completed questionnaire  Instrument: Medical Outcomes Social Support survey, 8 items of emotional support (higher more support) Scale 0-100  Mean 52 (SD 24)	Self-reported 4 day recall Adherent >90% doses taken over 4 days	Emotional support significantly associated with adherence:  Low emotional support: 70% adherence  Medium emotional support : 84% adherence  High emotional support: 96% adherence ( $P < .05$ for trend)  OR adherence 1.04 (95% CI 1.01-1.08) for every 1-point increase in emotional support	
Simoni JM 2007	HIV N = 136	Self-completed questionnaire Instrument: UCLA Social Support Inventory, 4 items each on scale 1-4 (higher more support)  Perceived satisfaction with support Scale 1-4 (higher more support)  Overall mean support 2.24 (SD 0.81) Mean satisfaction with support 3.13	Self-reported 3-day recall on dose, pill, and time adherence (each average % over 3 days)  Mean dose 80% Mean pill 83% Mean time 70%	No significant association	

		(SD 0.71)			
Singh N 1999	HIV  N = 123	Self-completed questionnaire  Instrument: Social Support Questionnaire, 4-point scale for emotional support (higher less support)	Refill adherence Adherent >90% refills at 6 mo Nonadherent <90% refills  18% nonadherent 82% adherent	No significant association  Mean emotional support 7.1 (SD 1.1) in nonadherent and 5.4 (SD 0.3) in adherent	

COMBINATION STUDIES					
Author/Year	Disease/No.	Social Support Measure	Adherence Measure	Adherence Outcome	Limitations
Barnhoorn F 1992	Tuberculosis  N = 102	Self-completed questionnaire  3 questions (yes/no) Presence of family support Positive attitude of family Support from spouse	Nonadherent: failure to take >15 days' duration of tuberculosis drugs	No significant association between adherence and presence of family support of positive attitude of family  Support from spouse significantly higher in adherent group (42%) than nonadherent group (19%) $P = .02$	
Chisholm-Burns MA 2010	Renal transplant  N = 61	Self-completed questionnaire  Instrument: Social Support Survey-5 5 items, each on 5-point Likert scale (higher more support) (3 emotional and 2 practical) in previous 4 wk  Score range 5-25  Mean score 19.1 (SD 5.2)	Immunosuppressant Therapy Adherence Scale 4 items, each on 4-point scale (higher more adherent)  Mean score 11.1 (SD 2)	Significant univariate association between Immunosuppressant Therapy Adherence Scale and Social Support Survey-5: (correlation $r = 0.214$ , $P < .05$ )  Overall Social Support Survey-5 explained 24% of variance in adherence in multivariable regression	Sample size
Cummings KM 1982	Hemodialysis  N = 116	Self-completed questionnaire  3 items, each on 7-point Likert scale, measuring how support persons make it easier for the patient to comply	Serum phosphorus levels (mean over 2-4 mo), adherent <5.5 mg/dL  Mean 5.8 (SD 1.3) 30% adherent  Self-report of	No significant association	

		(nonspecific) Mean 5.5 (SD 1.6)	adherence with phosphorus-lowering medications in 7-point Likert scale (higher more adherent)  Mean 6 (SD 1.2)		
Demas PA 2005	HIV N = 78	Interview 8 items, each on 5-point Likert scale, assessed if they could depend on others for emotional and practical support	Urine assay for ZDV drug  Mean corpuscular volume > 100 fL	No significant association	
Evangelista LS 2001	Heart failure N = 82	Self-completed questionnaire and interview  3 subscales (support from family, peers, or others), each with 4 items (each on 7-point Likert scale) Possible range 12-84  Mean 72 (SD 13)	Self-reported adherence, 5-point Likert scale, (higher more adherent)	No significant association	
Ferguson K 1979	Rheumatoid arthritis N = 32	Interview 4 items, qualitative assessment of family support	Self-reported adherence with aspirin, those not taking aspirin "often" were nonadherent  22% nonadherent	No significant association	
Gardenier 2010	HIV N = 56	Self-completed questionnaire  Instrument: Social Provisions Scale: 24 items, each on scale 1-4 (6 subscales, 4 for emotional support and 2 for practical support)  Score range 24-96 Mean score 73	AIDS Clinical Trial Group (ACTG) adherence follow-up instrument: self-report adherence <95% or >95%  55% adherent 45% nonadherent	Social support significantly higher in adherent group vs nonadherent group: Mean 75.1 vs 68.7, P = .02	Sample size
Gillibrand R 2007	Diabetes N = 50	Self-completed questionnaire  Instrument: Diabetes Family Behavior Checklist, 16 items, each 5-point Likert	Self-report 1 item, number of days in past 7 days they have adhered to insulin regimen	No significant association	

		scale (higher more support) Mean 13.3 (SD 5.3)			
Gonzalez JS 2004	HIV N = 90	Self-completed questionnaire  Instrument: Social Provisions Scale: 24 items, each ranked 1-4 (6 subscales, 4 for emotional support and 2 for practical support)  Score range 24-96	4 day pill count Adherent: 100% of pills over 4 days. Nonadherent: <100%  66% adherent 34% nonadherent	OR adherence was 1.9 (95% CI 1.1-3.2, $P < .05$ ) for every 1-point increase in social support	Sample size
Gordillo V 1999	HIV N = 366	Self-completed questionnaire  Instrument: Beck inventory questionnaire, 10 items on social support (overall yes/no)  70% yes (perceived social support)	Pill count method, "adherent" >90% of prescribed pills	OR adherence 2 (95% CI 1.3-3.3) for those with support vs those without support  Support present in 62% of adherent vs 38% of nonadherent	
Heiby EM 1989	Diabetes N = 144	Not described	8 items, 1 medication-specific item "How often do you forget to take your medications?"  Overall mean 25.8 (SD 4.2)  "Adherence" was above the median score, "Nonadherence" was below the median score (median score 26)	Social support from family and friends was significantly higher in adherent vs nonadherent group ( $P < .03$ )	Social support not described  Overall adherence score of 8 behaviors, only 1 referred to medications
Hilbert GA 1985	Myocardial infarction N = 60	Self-completed questionnaire  Self-reported supportive behaviors from spouse, 32 items, each 5-point Likert scale (higher more support)	Self-reported adherence of 10 behaviors (one of which was medication), each on Likert scale 0-4 (higher more adherent)  Mean adherence 82% (SD 12%)	No significant association between total spouse support and adherence  ( $r = -.056$ , $P = .337$ )	Sample size  Overall adherence score of 10 behaviors, only 1 referred to medications

Hilbert 1989	Hemodialysis N = 58	Self-completed questionnaire  Instrument: Social Support Questionnaire: 14 items (4 of “affection,” and 10 of “directive guidance”) each rated 1-5 (higher more support)  Mean 39.6 (SD 14.2)	Self-report adherence to medication in the previous week, rated 0 (none) to 4 (all the time)  Mean 3.5 (SD 0.9)	No significant association	Sample size
Irvine J 1999	Arrhythmia N = 671	Self-completed questionnaire  Instrument: Multidimensional Scale of Perceived Social Support, Health and Daily Living Form (social network contacts and social participation subscales)	Pill count mean over 2 y Adherent >66% Nonadherent <66%  22% nonadherent	No significant association	
Lebovits AH 1990	Cancer N = 51	No description of social support scale	% chemo missed over 26 wk nonadherent <90%  57% adherent 43% nonadherent	No significant association	Sample size No description of social support scale
McCaul KD 1987	Diabetes N = 107	Interview Instrument: Diabetes Family Behavior Checklist  Positive family behaviors mean 21 (SD 5)  Negative family behaviors mean 14 (SD 3.8)  Family relationship index (measures general family support) mean 21 (SD 8)	Self-monitored % injections within 30 min of mealtime  Self-reported % injections taken when supposed to (4-point scale)	No significant association in adults	Sample size
Murphy DA 2004	HIV N = 115	Interview Instrument: Social Provisions Scale: 24 items, each ranked 1-4 (6 subscales, 4 for emotional support)	Self-reported adherence >95%  Past 3 days: 58% Past week: 35% Past month: 26%	Multivariate regression:  3-day adherence not significantly associated with	

		and 2 for practical support)  Mean score 72 (SD 10.8)		overall support  Past week adherence significantly lower with higher overall support (OR 0.91, 95% CI 0.84-0.98)  Past month adherence not significantly associated with overall support	
Power R 2003	HIV  N = 73	Self-completed questionnaire  Instrument: UCLA Social Support Inventory, rated several types of support (emotional and practical) from 3 sources (partner, friends, and family) on 7-point Likert scales	Self-reported 4-day recall	Higher support from partners was associated with fewer missed medication doses ( $\beta = -0.113, P = .04$ )  No association with support from friends or family	Sample size
Rabinovitch M 2009	Psychosis  N = 100	Semistructured interview Provider-rated and patient-rated assessment of social support, 1 item, dichotomized as “good support” or “moderate/infrequent support”  Provider-rated good support 37%  Patient rated good support 55%	Self-reported % medications taken over 4 wk, on 5-point Likert scale (0%, 1-25%, 26-50%, 51-75%, 76+%) at 4 time points (months 1, 2, 3, and 6)  Adherent (>75% doses taken)  Adherent 55%	Significant association between provider-rated support and adherence : good support in 37% of nonadherent and 64% of adherent patients ( $P = .02$ )  No significant association between patient-rated support and adherence	
Ruggiero L 1990	Diabetes  N = 98	Self-completed questionnaire  Instrument: Diabetes Social Support Questionnaire  2 items “receive support in complying with insulin” 5-point Likert scale	Diabetes Compliance Questionnaire, 4 items on insulin, each 5-point Likert scale  71% “always or frequently” adherent with insulin	Significant univariate association between social support and self-reported adherence ( $r = .49, P < .01$ )	

		60% “always or frequently”			
Schlenk EA 1984	Diabetes  N = 30	Self-completed questionnaire  18 items, each 5-point Likert scale, total possible points on scale 18-90 (higher more support)  Mean 60 (SD 15)	Overall adherence in 6 behavioral areas, 1 of which was insulin  Self-report on 8 items, scales range from 0-2 to 0-5, total possible points on scale = 35 (higher more adherent)	No significant association	Sample size
Stanton AL 1987	Hypertension  N = 50	Self-completed questionnaire  Instrument: Social support for adherence scale (5 items each 5-point Likert) for tangible and affective support. (higher more support)  Satisfaction with support, 1 item, 5-point Likert scale	Self-report medication adherence: 9 items in a 5-point Likert scale (higher score indicates better adherence)  Pill count ratios (pills taken)/(should have taken)*100  nonadherent: <80%  54% adherent 46% nonadherent	Mean support significantly higher in adherent vs nonadherent group (mean 20 vs 15.5, $P < .005$ )  Mean satisfaction of support significantly higher in adherent vs nonadherent group (mean 4.4 vs 3.6, $P < .05$ )	Sample size
Tretharne GJ 2004	Rheumatoid arthritis  N = 85	Self-completed questionnaire  Instrument: Social Support Questionnaire, each item on 6-point Likert scale (higher more support)	19 items, each 4-point Likert scale	No significant association	Sample size
Vyavaharkar M 2007	HIV  N = 224	Interview Instrument: Medical Outcomes Study Social Support Survey, 19 items of 4 dimensions of social support availability (3 emotional and 1 practical) each on 5-point Likert scale  Social Support Questionnaire to measure source and	Self-report in past month  Adherent “never missed medications”  Nonadherent all others  36% adherent  Reasons for missed medications, 14 items, each 4-point	Social support availability not significantly associated with adherence  Social support satisfaction significantly higher in adherent vs nonadherent patients (mean 31 vs 28, $P = .02$ ) <b>[Au: P value correct as edited?]</b>	

		satisfaction of support, 6 items, each on 6-point Likert scale  Mean 29 (SD 10)	Likert scale (higher more reasons for missed medications)	Significant univariate correlation between social support availability and fewer reasons for missed medications ( $r = -0.16, P < .05$ )  No significant association between social support satisfaction and reasons for missed medications	
Wang PS 2002	Hypertension  N = 496	Telephone interview 2 items to measure how much friend/family helped the patient take medications, each scored 0-2  Total score range 0-4	Pill count over 1 year	No significant association between support and adherence  (OR adherence 0.93, 95% CI 0.71-1.21)	
Wu JR 2008	Heart failure  N = 134	Self-completed questionnaire  Instrument: Perceived Social Support Scale, 12 items, 7-point Likert scale (range 7-84) (higher more support)	Pill count by medication event-monitoring system for 3 months  Mean % prescribed doses taken 89%  Mean % days that correct doses were taken 81%  Mean % doses taken on schedule 67%	Higher perceived social support significantly predicted fewer % doses missed (multivariable regression $\beta = -0.241, P = .014$ )	

<b>INTERVENTIONAL STUDIES</b>				
<b>Author/Year</b>	<b>Disease/No.</b>	<b>Intervention</b>	<b>Outcome</b>	<b>Findings</b>
Jones DL 2003	HIV N = 174	Cognitive-behavioral stress management expressive-supportive therapy, 10 weekly sessions	Self-reported medication adherence, 14 items  Adherent >80% Low adherent <80%	No significant improvement in adherence overall  Subgroup of low adherent: intervention group increased adherence 30% vs 20% in the control group

Remien RH 2005	HIV couples N = 215	Four 1-hour educational session focused on medication adherence, barriers, communication, problem-solving, support, and confidence building	Pill count by medication event-monitoring system at week 8	Significantly higher % achieved >95% adherence in intervention group (35% vs 19%, $P = .02$ )
Simoni JM 2007	HIV N = 136	Peer support groups and telephone contacts. 6 twice-monthly 1-hour group meetings, and weekly phone calls	Pill count by medication event-monitoring system	No effect of intervention on adherence