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Application of "*Partnership Care Model*" in chronically ill adults and children: A systematic review and dose-response meta-analysis of randomized controlled trials

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ABSTRACT

Background: "*Partnership Care Model (PCM)*", which is the first partnership conceptual framework founded on the Iranian culture to control chronic diseases, has been recently used in different fields of nursing research with no levels of valid evidence to support its application. Therefore, this systematic review and meta-analysis sought to clarify the impacts of interventions developed based on PCM on quality of life (QoL), sleep quality, anxiety, and depression among adults and children with chronic diseases.

Methods: International data sources (e.g., PubMed, Web of Science, Scopus) and national databases (e.g., SID, MagIran, IranDoc, IRCT) were searched from 2001 to September 23, 2023, to find Randomized Controlled Trials (RCTs) on PCM-driven interventions for the experimental groups versus no intervention or standard care groups. The studies' methodological quality and evidence quality were rated utilizing the Cochrane risk of bias instruction and the Grading of Recommendations Assessment, Development, and Evaluation (GRADE). Data were pooled by a random-effects approach employing STATA (vers. 11.2).

Result: Eighteen RCTS, reported in 22 publications, were qualified. The PCM compared to the standard care significantly improved the QoL among both adults (10 effect sizes [ESs], mean difference [MD]: 3.17, $P < 0.001$) and children (4 ESs, MD: 4.45, $P < 0.001$). Likewise, the intervention enhanced adults' sleep quality (3 ESs, MD: 7.15, $P < 0.001$). The anxiety of adults and children was also significantly lower in the PCM group (4 ESs, MD: −4.52, $P = 0.001$; 2 ESs, MD: −4.04, $P < 0.001$, respectively). However, regarding depression, a significant effect of PCM was found only among children (3 ESs, MD: −7.99, $P = 0.011$). The methodological quality of the studies and the evidence quality were undesirable.

Conclusion: The PCM had a promising influence on the caring of adults and children suffering from chronic diseases. However, additional high-quality RCTs are needed to generate a higher quality of evidence concerning the clinical benefits of the PCM.

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1. Introduction

The prevalence of chronic diseases is rising worldwide due to shifts in lifestyle, continuous technological advancements, and the urbanization and industrialization of countries (Jiang & Wang, 2022). Chronic conditions need a caring strategy distinct from the predominant care method for acute illnesses (Holman, 2020). Control of these diseases requires the persistent and collaborative actions of different individuals, such as the patient and his/her family members and friends, physicians, and nurses as a team (Coyne et al., 2020). Indeed, the partnership of all parties, especially the patients, is imperative in optimizing the care process for chronic diseases (Mohammadi et al., 2022). Hence, it is essential to improve the patients' partnership in chronic disease control through well-designed partnership caring approaches (Fujiwara & Endo, 2017).

In recent years, various caring models have been suggested in different societies to improve the partnership among chronically ill patients, such as the "*Primary Care Provider–Case Management Partnership Model*" for dementia care (Frost et al., 2020), "*Nurse-Family Partnership Model*" for seriously ill children (Tallon et al., 2015), "*Palliative Care Partnership Model*" for primary care (McKinlay & McBain, 2007), "*Like-Minded Thinking Partnership Model*" to sustain hope for the person with cancer (Ayers, 2007), and "*Partnership Care Model of Advanced Practice Psychiatric Nurses*" (Nelson et al., 2021). Concerning this, the usefulness of a care model that conforms to society's culture should be considered, as civilization has an essential influence on applying caring models in diverse communities (Effendy et al., 2015).

In Iran, a developing country in Western Asia, the first partnership model, called the "*Partnership Care Model (PCM)*", was developed by Mohammadi et al. in a grounded theory study to control Hypertension (HTN) (Mohammadi et al., 2002). The PCM is defined as a systematic and analytical approach to establishing a practical and interactive relationship among the partnership team members, including the patient unit (patients and/or their relatives who are interested in the treatment process and disease control), nurse(s), and clinician(s) (Rahimi-Bashar et al., 2020). The main aims of the PCM are to better understand the requirements, concerns, and expectations in the management of the disease process; to increase cooperation, inspiration, and responsibility among the partnership team members; to improve the patients' awareness regarding the disease, self-care, commitment to therapy, and follow-up; and to decrease disease complications, which all provide an opportunity to improve patients' health status and the quality of care (Aghakhani et al., 2020; Mohammadi et al., 2006). Four interrelated stages have been presented to accomplish these aims: motivation, preparation, involvement, and evaluation (Mohammadi et al., 2002) (Fig. 1).

In the first assessment of the PCM, the positive consequence of a care plan founded on this model was reported on the health-related Quality of Life (QoL) of clients with HTN (E. Mohammadi et al., 2006). Since then, Randomized Controlled Trials (RCTs) have tested the potential impacts of PCM-driven interventions on QoL of clients with various chronic diseases, such as stroke (Mohammadi et al., 2022), diabetic foot ulcers (Aghakhani et al., 2020), diabetes (Mohammadi et al., 2011), asthma (Daneshi et al., 2014), heart failure (HF) (Abbasi et al., 2015), coronary artery disease (CAD) (Rezapoor et al., 2017; Zare Shorakie et al., 2017), cancer (Khachian et al., 2022), and major thalassemia (Shahdadi et al., 2018). Additionally, studies reported that implementing the PCM was effective in improving sleep quality and alleviating anxiety and depression among different chronically ill clients (Alamdarloo et al., 2015; Fahami et al., 2018; Nayyeri et al., 2015; Rezapour et al., 2016; Shamsi et al., 2017).

In addition to RCTs, recent reviews addressed the potential impacts of the PCM on managing chronic diseases (KhoshFetrat et al., 2023; Meshkani et al., 2020; Rahimi-Bashar et al., 2020). In a review of the application of the PCM on the outcomes of chronic diseases, the usefulness of PCM was documented (Rahimi-Bashar et al., 2020). In another review, the PCM was reported as an effective approach in improving patients' sleep quality (Meshkani et al., 2020). Also, a recent meta-analysis of three studies displayed the efficiency of PCM on chronic patients' QoL (KhoshFetrat et al., 2023). These reviews overlooked several pertinent trials in their synthesis because they did not perform a comprehensive search or screening process. Likewise, previous reviews did not consider study type and patients' age group in their inclusion criteria; consequently, they incorporated the results of RCTs and quasi-experimental studies conducted on different age groups (i.e., children, teenagers, adults, or elders), making it challenging to reach a reasonable evidence-based conclusion on the value of PCM. Considering these reasons and the importance of studying care models to provide valid evidence for contemporary and future practice (Nasiri et al., 2023), the present systematic review sought to summarize and pool the results of available RCTs regarding the effects of PCM-based interventions on chronically ill adults' and children's QoL as the primary outcome and their quality of sleep, anxiety, and depression as the secondary outcomes.

2. Methods

2.1. Study design

The protocol received approval from the Abadan University of Medical Sciences, Iran (No. 1239). It was also documented in the International Prospective Register of Systematic Reviews (PROSPERO; No. CRD42021253790). This review was structured using the last statement of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Page et al., 2021).

2.2. Eligibility criteria

The studies were deemed eligible if they: 1) included either children (aged eight years to less than or equal to 20 years) or adults (aged > 20 years to 70 years) who experienced any chronic diseases, 2) compared the effects of implementing interventions based on the PCM to either standard care or no intervention, 3) considered QoL, quality of sleep, anxiety, or depression as the study outcomes, and 4) were conducted with any type of RCT designs. The records were excluded if they: 1) were duplicates, review studies, letters, case reports, and book sections, 2) did not have available English abstracts, full-texts, or published findings, 3) followed a quasi-experimental controlled trial design, and 4) recruited individuals over 70 years of age (due to different nature of chronic diseases in this age group).

2.3. Search methods

An electronic search was conducted in six international data sources: Cochrane Central Register of Controlled Trials (CENTRAL), Excerpta Medica database (EMBASE), PubMed, Web of Science (Core Collection), Scopus, and Cumulative Index to Nursing and Allied Health Literature (CINAHL, Plus with Full Text). To retrieve more relevant studies, an extra search was accomplished in three Iranian databases, including the Iranian Research Institute for Information Science and Technology (IranDoc), the Scientific Information Database (SID), and MagIran. Four other Iranian databases were searched for trial register entries to obtain information regarding the completed trials, namely

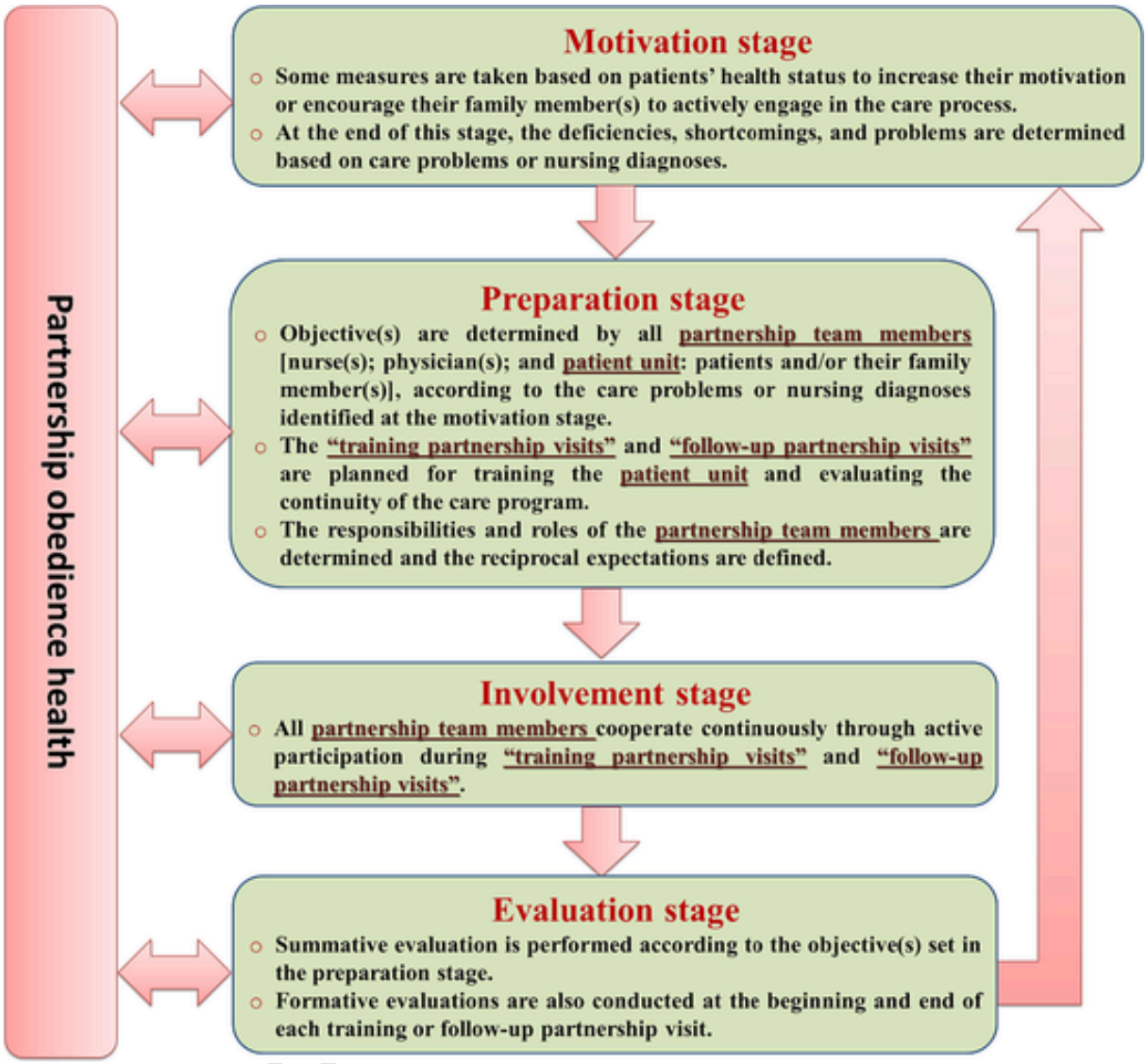

Fig. 1. The four implementation stages of the "*Partnership Care Model*" (Mohammadi et al., 2002).

the Iranian Registry of Clinical Trials (IRCT), Iran National Committee for Ethics in Biomedical Research, Iran Research Proposal Information System (RPIS), and Iran Database of Medical Sciences Theses. If a completed trial was not found in the search conducted in the data sources, it was searched on the sponsor's website and Google Scholar. If necessary, relevant individuals or organizations were contacted via email or phone to gain details about the trial. Finally, the references of all appropriate investigations and earlier reviews were inspected to discover further related work.

Two independent researchers searched all data sources from January 2001 (the date of the PCM development) using relevant terms or/and keywords (Supplementary Table 1). First, a search was accomplished in April 2021, and an email alert service was made to specify new investigations that might be publicized since then. Secondly, a search was completed on February 28, 2022. Finally, an additional search was executed on September 23, 2023, to determine appropriate recent eligible records. The searches were not restricted to the clinical conditions, participants, and publication language to find further related studies. Any hesitation or controversy among the researchers during the search was settled via back-and-forth. The agreement between the researchers was confirmed by the Kappa coefficient (*K*) (Landis & Koch, 1977), which ranged from 0.74 to 0.83.

2.4. Quality appraisal

The methodological quality of the included studies was addressed by the Cochrane Risk of Bias (ROB) Assessment Tool (Higgins & Green, 2011). To this end, the included publications and their trial register entries were scrutinized. To subgroup data based on the ROB results, each study was categorized concerning the methodological quality as follows: 1) high quality: low ROB in all items, 2) moderate quality: unclear ROB in ≤two items, and 3) low quality: high ROB in one item or unclear ROB in ≥three items (Nasiri et al., 2021).

For each study outcome, the overall evidence quality was ranked as high, moderate, low, and very low, utilizing the approach presented by Grading of Recommendations Assessment, Development, and Evaluation (GRADE). The evidence was downgraded depending on the presence of five suggested items (i.e., inconsistency, indirectness, imprecision, ROB, and publication bias) (Schünemann et al., 2013).

2.5. Data extraction

For each included publication, the following data were documented on an electronic data extraction form: 1) study design and groups, 2) authors' names and publication year, 3) participants' characteristics, 4)

PCM details (i.e., number and duration of partnership visits and training methods), 6) study instrument(s), 7) study outcome(s), 8) findings, and 9) methodological quality. For one three-arm trial, the data were obtained for the PCM and control groups (Shahdadi et al., 2018). The data of one study that only reported the component scores were summed up to get a total score (Azadi & Mohammadi, 2006). Moreover, the data of one study that reported a total score in parent and child reports were pooled (Alijany-Renany et al., 2012).

The study screening, selection, and data extraction were accomplished by three investigators independently. Similarly, the quality appraisal was conducted by three other investigators independently. In case of inadequate or ambiguous information, the RCTs' corresponding authors were contacted via email to acquire further details. Any disagreement among the investigators was fixed via consensus with another investigator. The agreement level among the investigators was moderate-to-substantial (K = 0.56–0.73).

2.6. Data management and analysis

First, the mean and standard deviation (SD) of measured outcomes were obtained. Then, changes in means and SDs for each study group were estimated based on the values presented in the baseline and the end of the trial. Subsequently, a random-effects method was utilized to compare the changes in means and SDs between groups and obtain the effect sizes (ESs). If studies employed an exact measurement, the ESs were calculated as the weighted mean difference (WMD) with 95 % confidence intervals (CIs). On the contrary, the standardized mean difference (SMD) with 95 % CIs was estimated if different scales were used.

Statistical analyses were accomplished employing STATA (vers. 11.2, Stata Corp, College Station, TX). For the overall analyses, P-values were deemed significant at <0.05. Also, to specify the heterogeneity between the studies, the I-squared statistics (I^2) $\geq$ 50 % and Cochran's Q test values $<$ 0.05 were assumed significant (Higgins & Green, 2011). In case of substantial between-study heterogeneity, subgroup analysis and meta-regression were performed to determine the probable heterogeneity sources. Additionally, sensitivity analyses were conducted to explore the dependence of the overall estimate on the ES from an individual study. Furthermore, publication bias was addressed according to Begg's rank test, Egger's regression test, and the graphical appraisal of the funnel plots. If there was substantial publication bias, the approach of trim-and-fill was followed to see the consequences of the probable missing trials on the overall estimations. Finally, fractional polynomial modeling was run to specify the non-linear dose-response impacts of the total number and duration of partnership visits on the study outcomes.

3. Results

3.1. Search result

The flow diagram of evaluated records is demonstrated in Supplementary Fig. 1. In the searches performed in the data sources, 5726 records were found. Besides, 12 additional documents were discovered by searching the references of available reviews and eligible RCTs. After screening full-text of 50 reports based on the eligibility criteria, 12 were excluded due to the following reasons: 1) recruited individuals over 70 years of age (Abbasi et al., 2015; Aghakhani et al., 2020; Mohammadi et al., 2022; Nayyeri et al., 2015), 2) had a one-group pretest/posttest design (Ghavidel et al., 2009; Hoseini & Koshnevis, 2007; Khoshnevis et al., 2009; Tabarsy et al., 2018), 3) followed a non-randomized controlled trial design (Zamani et al., 2021), and 4) published findings could not be obtained even after contacting the responsible person for scientific inquiries (Masoumian Hosseini et al., 2016; Parizi et al., 2020; Sedaghat et al., 2019). Finally, 22 publications (21 journal articles and one thesis) and 16 trial register entries were qualified for the present review. Four of the 22 included publications were multiple reports from the same study; however, all were included since each reported different outcome variables (Borhani et al., 2012; Foroutani et al., 2014; Khoshab et al., 2012; Parviniannasab et al., 2014; Rezapoor et al., 2017; Rezapour et al., 2016; Zinati, Kashaninia, et al., 2016; Zinati, Khashaninia, et al., 2016). Hence, a total of 18 studies, reported in 22 publications, were included.

3.2. Descriptions of studies

The summary of 18 included RCTs is outlined in Table 1. They were published from 2006 to February 2023. All studies were performed with a parallel-group design and two arms, except one with a three-arm design (Shahdadi et al., 2018). The sample size in both PCM and control groups ranged from 20 to 75. Study participants were children with major thalassemia (n = 7) and leukemia (n = 1). On the other, 14 publications addressed adults who had experienced different types of chronic diseases.

3.3. Study outcomes

3.3.1. Quality of life

Ten included studies measured QoL of adults with cardiovascular diseases (n = 6), diabetes (n = 1), stroke (n = 1), cancer (n = 1), and asthma (n = 1). These studies applied different point scales, including the Short-Form 36 Health Survey Questionnaire (SF-36, n = 5), Nottingham Health Profile (NHP, n = 1), Quality of Life Questionnaire (QLQ-C30, n = 1), and specific measures of QoL for patients with asthma (n = 1), HF (n = 1), and stroke (n = 1). Pooled analysis revealed that the adults' QoL significantly improved in the PCM group compared to the standard care group (SMD: 3.17, 95 % CI: 1.93 to 4.42; P < 0.001; I^2: 97.3 %) (Fig. 2a). After pooling data from five RCTs that applied SF-36 (score: 0–100), the overall ES was comparable with the primary result (WMD: 12.97, 95 % CI: 5.21 to 20.72; P = 0.001; I^2: 97.0 %).

Out of four studies that documented children's QoL, three used the Pediatric Quality of Life Inventory (Peds-QL) among children with thalassemia (n = 2) and leukemia (n = 1). The remaining studies applied SF-36 for thalassemia. Similar to the adults, a significant effect of the PCM was observed on boosting children's QoL (SMD: 4.45, 95 % CI: 2.33 to 6.56; P < 0.001; I^2: 95.9 %) (Fig. 2b). After excluding the only RCT that used SF-36, the overall pooled ES for the remaining three RCTs that employed the Peds-QL (score: 0–100) was consistent with the primary result (WMD: 20.26, 95 % CI: 6.70 to 33.82; P = 0.003; I^2: 97.8 %).

3.3.2. Quality of sleep

Three studies that addressed sleep quality used the Pittsburgh Sleep Quality Index. These studies recruited adults with HF and those with renal failure undergoing hemodialysis and CAD undergoing coronary artery bypass grafting surgery. Pooled analysis revealed the substantial effect of the PCM compared to standard care on enhancing adults' sleep quality (WMD: 7.15, 95 % CI: 4.91 to 9.39; P < 0.001; I^2: 97.7 %) (Fig. 3).

3.3.3. Anxiety

Four included studies measured the anxiety of adults with cardiovascular diseases (n = 3) and hematological cancer (n = 1). These studies used different point scales, including the Beck Anxiety Inventory (BAI, n = 2), the Depression, Anxiety, and Stress Scale (DASS, n = 1), and the Spielberger State Anxiety Inventory (SAI, n = 1). The pooled analysis displayed that the adults' anxiety was significantly lower in the PCM group compared to the standard care group (SMD: −4.52, 95 % CI: −6.78 to −2.27; P = 0.001; I^2: 97.3 %) (Fig. 4a).

Table 1
Summary of the studies on the effects of the "*Partnership Care Model*" on the quality of life, quality of sleep, anxiety, and depression among Iranian adults and children with chronic diseases.

Authors (publication year)	Participants	Study arms: Sample size (age: mean ± SD)	PCM details				Study instrument (measurement times)	Outcome (s)	Findings[a]	Study methodological quality
			Training partnership visits	Follow-up partnership visits	Total number and duration of partnership visits	Training method(s)				
Mofidi et al. (2023)	Children with leukemia	PCM: 30 (8.46 ± 2.25) RC: 30 (9.06 ± 2.21)	Four 45–60-min visits with 7-day intervals	Two 30–45-min visits with a 14-day interval	Six visits during 42 days (240–330 min)	Pamphlet, lecture, question and answer	Peds-QL 3.0 Cancer Module (T1: baseline, T2: 2 months after the end of intervention)	QoL	Significantly improved in T2	Low[b]
Khachian et al. (2022)	Adults with hematological cancer	PCM: 30 (32.93 ± 10.27) RC: 30 (36.60 ± 12.35)	Four 45–60-min visits with 7-day intervals	Two 45–60-min visits with a 30-day interval	Six 45–60-min visits during 81 days (270–360 min)	Lecture, question and answer, booklet	QLQ-C30 (T1: baseline, T2: 1 month after the end of the intervention; T3: 3 months after the end of the intervention)	QoL	Significantly improved in T2 and T3	Low[b]
							BAI (T1: baseline, T2: 1 month after the end of the intervention; T3: 3 months after the end of the intervention)	Anxiety	Significantly decreased in T2 and T3	
Shahdadi et al. (2018)	Children with major thalassemia	PCM: 30 (13.83 ± 1.91) RC: 30 (13.80 ± 1.98)	nr.	nr.	Four 45-min visits during 14 days (180 min)	Lecture, question and answer, interview, group discussion	Peds-QL (T1: baseline, T2: 45 days after the end of the intervention)	QoL	Significantly improved in T2	Low[b]
Fahami et al. (2018)	Adults with CAD	PCM: 30 (nr.) RC: 30 (nr.)	Three visits with 14-day intervals	Two visits with a 14-day interval	Five visits during 56 days	nr.	SF-36 (T1: baseline, T2: 3 months after the end of the intervention)	QoL	Significantly improved in T2	Low[b]
							PSQI (T1: baseline, T2: 3 months after the end of the intervention)	Sleep quality	Significantly improved in T2	
Zare Shorakie et al. (2017)	Adults with CAD	PCM: 29 (56.17 ± 6.39) RC: 29 (57.45 ± 6.97)	Three 40–60-min visits with 10-day intervals	Four 40–60-min visits with 14-day intervals	Seven 40–60 min visits during 86 days (280–420 min)	Lecture, photo presentation, discussion, role play	NHP (T1: baseline, T2: 1 month after baseline, T3: 2 months after baseline, T4: 3 months after baseline)	QoL	Significantly improved in T2, T3, and T4	Low[b]
Shamsi et al. (2017)	Children with major thalassemia	PCM: 41 (15.25 ± 3.17) RC: 41 (15.03 ± 3.36)	Three 60–90-min visits with 14-day intervals	Two 30–45-min visits with a 14-day interval	Five visits during 56 days (240–360 min)	Lecture, PowerPoint presentation, pamphlet, question and answer	GHQ-28 (T1: baseline, T2: 3 months after baseline)	Anxiety and depression	Significantly decreased in T2	Low[b]
Rezapoor et al. (2017, 2016)	Adults with CAD undergoing coronary angioplasty	PCM: 25 (54.20 ± 8.10) RC: 25 (55.90 ± 7.60)	Three 45–60-min visits with 7-day intervals	Two 45–60-min visits with a 14-day interval	Five 45–60 min visits during 35 days (225–300 min)	Lecture, question and answer, group and individual discussion	SF-36 (T1: baseline, T2: 3 months after the end of the intervention)	QoL	Significantly improved in T2	Moderate[c]
							DASS-42 (T1: baseline, T2: 3 months after the end of the intervention)	Anxiety and depression	Significantly decreased in T2	

(*continued on next page*)

Table 1 (*continued*)

Authors (publication year)	Participants	Study arms: Sample size (age: mean ± SD)	PCM details				Study instrument (measurement times)	Outcome (s)	Findings[a]	Study methodological quality
			Training partnership visits	Follow-up partnership visits	Total number and duration of partnership visits	Training method(s)				
Zinati, Kashaninia, et al. (2016); Zinati, Khashaninia, et al. (2016)	Children with major thalassemia	PCM: 20 (18.00 ± nr.) RC: 20 (17.65 ± nr.)	Five 45–60-min visits with 14-day intervals	Three 45–60-min visits with 30-day intervals	Eight 45–60 min visits during 146 days (360–480 min)	Lecture, question and answer, pamphlet	SF-36 (T1: baseline, T2: 5 months after baseline)	QoL	Significantly improved in T2	Low[b]
							BDI (T1: baseline, T2: 5 months after baseline)	Depression	Significantly decreased in T2	
Alamdarloo et al. (2015)	Adults with CAD undergoing CABG surgery	PCM: 30 (53.87 ± 11.53) RC: 30 (52.57 ± 5.46)	Three 60–80-min visits with 14-day intervals	Two 30-min visits with a 7-day interval	Five visits during 42 days (180–300 min)	Lecture, question and answer, pamphlet	PSQI (T1: baseline, T2: at the end of the intervention)	Sleep quality	Significantly improved in T2	Low[b]
Daneshi et al. (2014)	Adults with asthma	PCM: 40 (nr.) RC: 40 (nr.)	Three visits with 14-day intervals	Two visits with a 14-day interval	Five visits during 56 days	Lecture, question and answer	QoL questionnaire for adults with asthma (T1: baseline, T2: 3 months after baseline)	QoL	Significantly improved in T2	Low[b]
Parviniannasab et al. (2014); Foroutani et al. (2014)	Children with major thalassemia	PCM: 30 (15.23 ± 2.44) RC: 30 (15.70 ± 2.26)	Two 120-min visits with a 7-day interval	One 120-min visit with a 7-day interval	Three 120-min visits during 14 days (360 min)	Group discussion, lecture, question and answer	DASS-21 (T1: baseline, T2: 3 months after baseline)	Anxiety and depression	Significantly decreased in T2	Low[b]
Lashkari et al. (2013)	Adults with renal failure undergoing HD	PCM: 26 (45.70 ± 10.20) RC: 26 (44.30 ± 9.60)	Three 60–70-min visits with 14-day intervals	Two 30-min visits with a 7-day interval	Five visits during 42 days (180–270 min)	Lecture, book, pamphlet	PSQI (T1: baseline, T2: 1 month after the end of the intervention)	Sleep quality	Significantly improved in T2	Low[b]
Borhani et al. (2012); Khoshab et al. (2012)	Adults with HF	PCM: 45 (61.96 ± nr.) RC: 45 (63.67 ± nr.)	Three 60–90-min visits with 14-day intervals	Two 60–90-min visits with a 14-day interval	Five 60–90-min visits during 56 days (300–450 min)	Lecture, movie, pamphlet, role play	QoL questionnaire for HF (T1: baseline, T2: 3 months after baseline)	QoL	Significantly improved in T2	Low[b]
							BDI (T1: baseline, T2: 3 months after baseline)	Depression	Significantly decreased in T2	
							BAI (T1: baseline, T2: 3 months after baseline)	Anxiety	Significantly decreased in T2	
Alijany-Renany et al. (2012)	Children with major thalassemia	PCM: 36 (10.30 ± 1.32) RC: 36 (10.22 ± 1.26)	Three visits	Two visits	Five visits during 56 days	Lecture	Peds-QL (T1: baseline, T2: 3 months after the end of the intervention)	QoL	Significantly improved in T2	Low[b]
Mohammadi et al. (2011)	Adults with type 1 or 2 diabetes	PCM: 50 (56.04 ± 12.61) RC: 50 (53.75 ± 13.56)	nr.	nr.	Three to four 45–60-min visits during 90–120 days (180–240 min)	Lecture, question and answer	SF-36 (T1: baseline, T2: 6 months after baseline)	QoL	Significantly improved in T2	Low[b]
Shokati Ahmad Abad et al. (2007)	Adults with CVA	PCM: 25 (nr.) RC: 25 (nr.)	Four 60-min visits with 14-day intervals	One 60-min visit	Five 60-min visits during 56 days (300 min)	Lecture, question and answer, educational clip, role play, poster, moulage	SS-QoL (T1: baseline, T2: during the intervention, T3: at the end of the intervention)	QoL	Significantly improved in T3	Low[b]

(*continued on next page*)

Table 1 (*continued*)

Authors (publication year)	Participants	Study arms: Sample size (age: mean ± SD)	PCM details				Study instrument (measurement times)	Outcome (s)	Findings[a]	Study methodological quality
			Training partnership visits	Follow-up partnership visits	Total number and duration of partnership visits	Training method(s)				
Mohammadi et al. (2006)	Adults with HTN	PCM: 75 (nr.) RC: 75 (nr.)	Four 40–45-min visits with 7-day intervals	Eleven 40–45-min visits with 30-day intervals	Fifteen 40–45-min visits during 360 days (600–675 min)	Discussion	SF-36 (T1: baseline, T2: 12 months after baseline)	QoL	Significantly improved in T2	Low[b]
							Spielberger SAI (T1: baseline, T2: 12 months after baseline)	Anxiety	Significantly decreased in T2	
Azadi and Mohammadi (2006)	Adults with CAD	PCM: 30 (53.40 ± nr.) RC: 30 (52.80 ± .nr.)	Three 60–80-min visits with 14-day intervals	Two 60–80-min visits with a 30-day interval	Five 60–80-min visits during 88 days (300–400 min)	Lecture, photo presentation	SF-36 (T1: baseline, T2: 3 months after baseline)	QoL	Significantly improved in T2	Low[b]

Abbreviations: BAI, Beck anxiety inventory; BDI, Beck depression inventory; CABG, coronary artery bypass graft; CAD, coronary artery disease; CVA, cerebrovascular accident, DASS, depression, anxiety, and stress scale; GHQ, general health questionnaire; HD, hemodialysis; HF, heart failure; HTN, hypertension; min, minutes; NHP, Nottingham health profile; nr., not reported; Peds-QL, pediatric quality of life inventory; PCM, partnership care model; PSQI, Pittsburgh sleep quality index; QLQ-C30, quality of life questionnaire; QoL, quality of life; RC, routine care; SAI, state anxiety inventory; SD, standard deviation; SF-36, 36-item short-form health survey; SS-QoL, stroke-specific quality of life scale; T, time.

[a] Outcomes in the PCM arm compared to the RC arm.

[b] Cochrane risk of bias assessment tool: high risk of bias in one item or unclear risk of bias in more than or equal to three items.

[c] Cochrane risk of bias assessment tool: unclear risk of bias in less than or equal to two items.

Two studies also evaluated the anxiety of children with thalassemia using either DASS or the General Health Questionnaire (GHQ). Comparable to the adults, the pooled analysis revealed that the PCM significantly reduced children's anxiety (SMD: -4.04, 95 % CI: −6.29 to −1.78; $P < 0.001$; I^2: 93.2 %) (Fig. 4b).

3.3.4. Depression

Two included studies measured depression of adults with cardiovascular diseases using the DASS or Beck Depression Inventory (BDI). Also, three studies addressed depression in children with thalassemia using BDI (n = 2), DASS (n = 1), and GHQ (n = 1). The pooled analysis revealed that the children's depression was significantly lower in the PCM group in comparison with the standard care group (SMD: -7.99, 95 % CI: −14.14 to −1.84; $P = 0.011$; I^2: 97.9 %). However, the intervention had a non-significant reducing impact on adults' depression (SMD: −7.66, 95 % CI: −16.41 to 1.09; $P = 0.086$; I^2: 97.8 %) (Fig. 5).

3.4. Subgroup analysis and meta-regression

According to the subgroup analyses, the total number of partnership visits could explain the heterogeneity among the studies for QoL of both adults and children. Also, the total duration of partnership visits and study instrument was a source of heterogeneity for adults' sleep quality and anxiety, respectively (Supplementary Tables 2 and 3). Nonetheless, according to the meta-regression, none of the variables was a source of heterogeneity for the study outcomes among adults and children (Supplementary Tables 4 and 5).

3.5. Sensitivity analysis

The pooled ESs obtained for adults' QoL, quality of sleep, and anxiety did not depend on an individual RCT (Supplementary Fig. 2). Similarly, the overall pooled ES obtained for children's QoL was not dependent on a singular study (Supplementary Fig. 3). Yet, sensitivity analysis revealed the dependency of the overall pooled ES obtained for children's depression on the studies of Shamsi et al. (2017) and Zinati, Kashaninia, et al. (2016), as ignoring each of these RCTs changed the significant effect of the intervention to non-significant (Supplementary Fig. 4). Performing sensitivity analysis was impossible for adults' depression and children's anxiety due to the limited number of ESs (n = 2).

3.6. Publication bias

Findings of Begg's rank and Egger's regression tests are outlined in Supplementary Table 6. Based on these tests, a moderate asymmetry was found for adults' QoL ($P = 0.001$ in two cases), which was also confirmed by visual inspection of the funnel plot (Supplementary Fig. 5). Also, according to Egger's test, a moderate asymmetry was found for adults' anxiety and children's QoL ($P = 0.013$, $P = 0.017$). However, no evidence of publication bias was discovered for other cases. Based on the trim-and-fill method, the average ESs obtained for adults' QoL and anxiety, as well as children's QoL, did not change, suggesting that publication bias did not affect the results.

3.7. Dose-response analysis

The total number of partnership visits had a significant relationship with changes in children's QoL score ($P = 0.036$) (Fig. 6). Nonetheless, no significant dose-response association was discovered between changes in the QoL score of adults and children and the total duration of partnership visits reported by day ($P = 0.289$, $P = 0.824$) (Supplementary Fig. 6). Similarly, the dose-response association was non-significant between the changes in the adults' QoL score and the total duration of partnership visits reported by minute as well as the total number of partnership visits ($P = 0.375$, $P = 0.504$) (Supplementary Fig. 7). Also, the association between the total number of partnership visits and changes in adults' anxiety score was not dose-dependent ($P = 0.695$) (Supplementary Fig. 8). Performing dose-response was impossible for other cases due to the low variations in the total number and duration of partnership visits.

3.8. Quality appraisal

The evidence quality was low for all outcome measures based on the GRADE. The evidence was mainly devalued due to the ROB, inconsis-

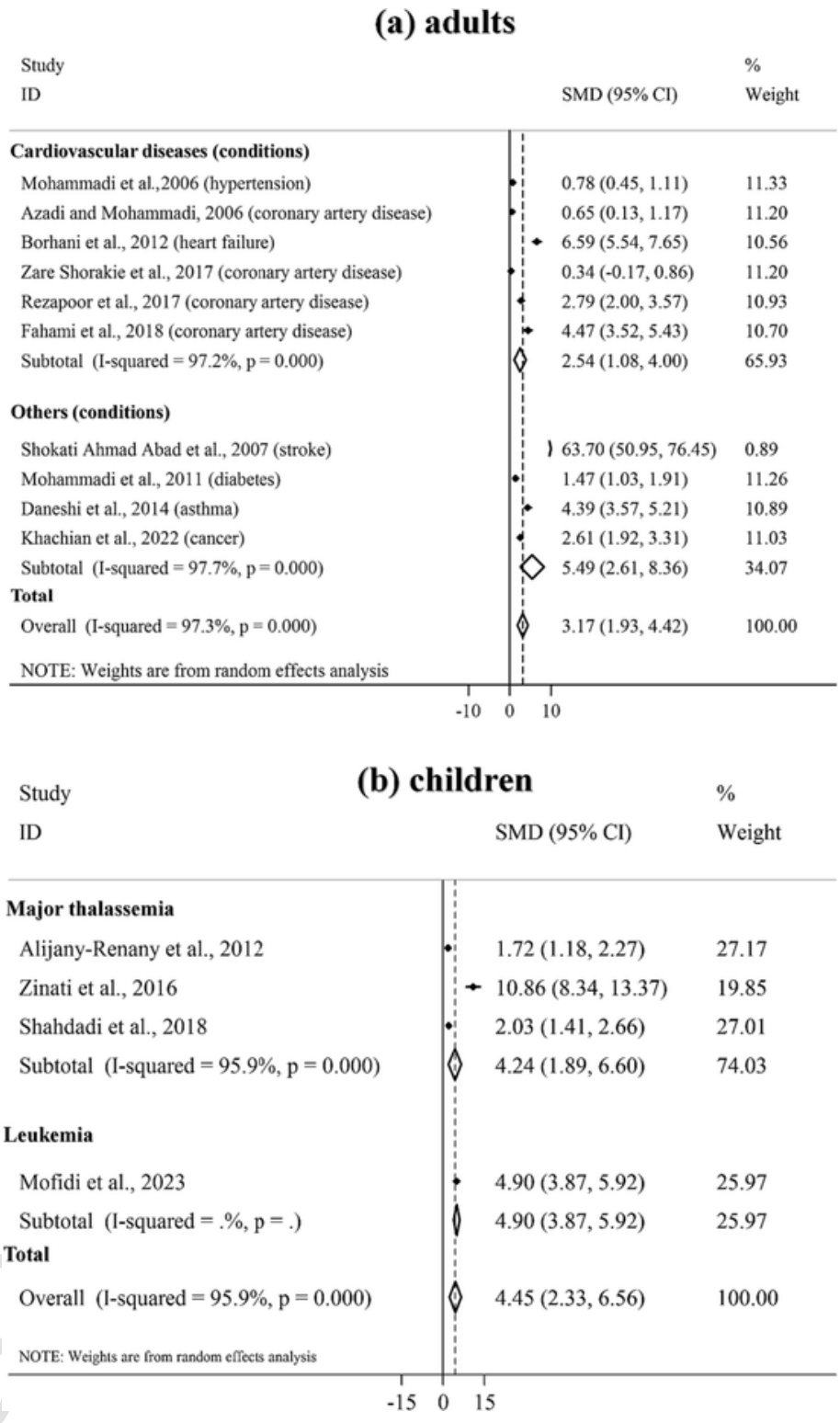

Fig. 2. Effect of the "*Partnership Care Model*" on the quality of life among Iranian chronically ill adults (a) and children (b) (note: data are stratified based on the clinical conditions).

tency, and publication bias (Table 2). Also, according to the Cochrane ROB tool, a low methodological quality was found among all included studies, except one rated moderate. All trials were well-addressed regarding the attrition bias, and most had a low ROB on reporting bias and other sources of bias. Considering the random sequence generation, 13 studies reported a low ROB. Nonetheless, the concealment of allocation was unclear in all RCTs. The blinding of participants and outcome assessors was also ambiguous in 21 and 20 studies, respectively (Figs. 7 and 8, Supplementary Table 7).

4. Discussion

Using a compatible intervention to a society's culture can play a pivotal role in improving patients' health status (Attaallah et al., 2021).

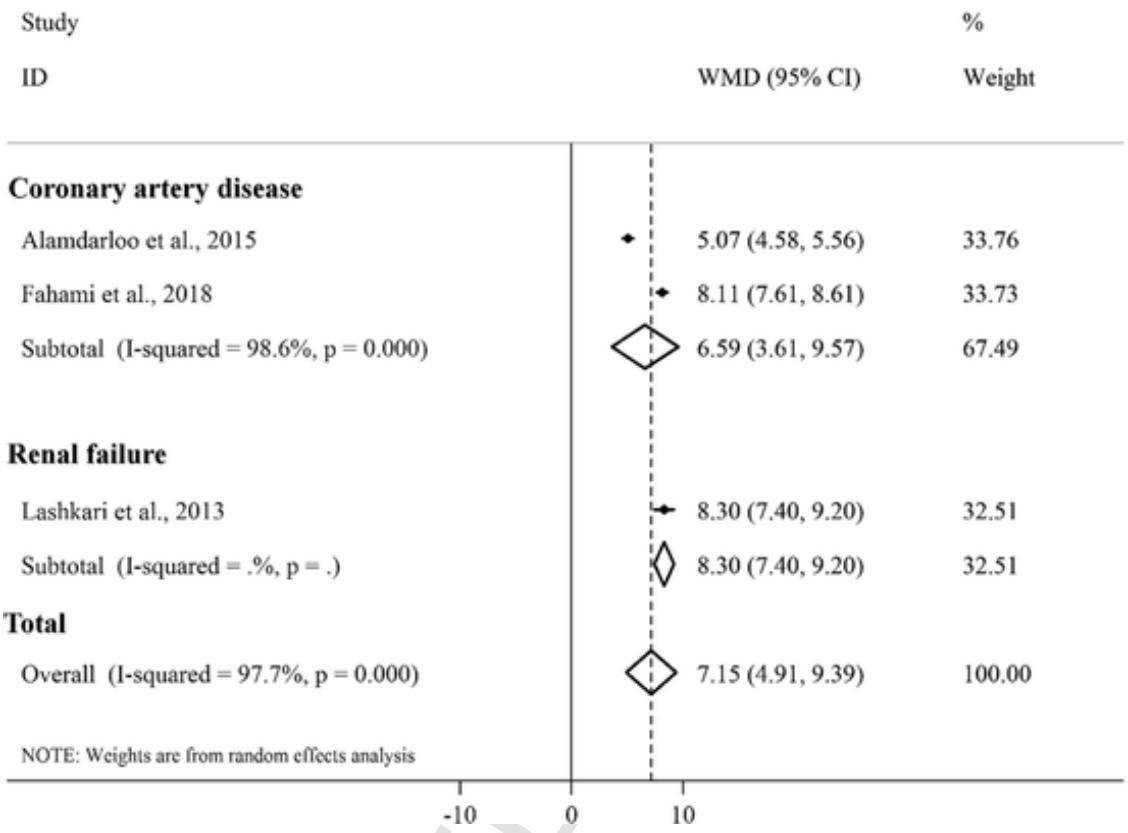

Fig. 3. Effect of the "*Partnership Care Model*" on the sleep quality among Iranian chronically ill adults (note: data are stratified based on the clinical conditions).

The PCM, which is consistent with the Iranian context, has been recently used in different fields of nursing research with no levels of valid evidence to support its application. Hence, the present review was conducted to elicit reliable conclusions regarding the effects of administering the care programs based on PCM on QoL as the primary outcome and quality of sleep, anxiety, and depression as the secondary outcomes. Based on the meta-analysis, similar findings were observed on the efficacy of PCM-driven interventions in boosting QoL and alleviating anxiety among adults and children. Regarding sleep quality, no studies recruited children. Nevertheless, pooled analysis indicated the superiority of PCM-based interventions compared to routine care programs in improving adults' sleep quality. Conversely, depression in adults and children was substantially reduced following participation in PCM, while the results were statistically significant only among children. This finding could be due to the higher sample size of studies performed on children than those recruited adults (n = 91 vs. n = 70).

The findings of this study updated previously published reviews, which reported the beneficial effects of PCM. A recent meta-analysis of three studies (i.e., one published quasi-experimental study among teenagers and two unpublished RCTs among adults) indicated that participants who received a program based on PCM compared to those who participated in a standard care program had significantly higher QoL scores in physical and psychological dimensions of SF-36 (KhoshFetrat et al., 2023). Also, a systematic review of 23 publications (i.e., seven quasi-experimental studies and 16 RCTs) documented until December 25, 2019, regarding the impacts of the PCM on the consequences of chronic disorders concluded that the caring interventions based on the PCM could be utilized to promote various dimensions of chronic conditions among different age groups (Rahimi-Bashar et al., 2020). Similarly, in another systematic review of four RCTs published until June 2019 on the effectiveness of the PCM on sleep quality, this model was suggested to enhance the sleep quality of adults and elders (Meshkani et al., 2020).

The findings of this review also substantiated the value of partnership care approaches developed in other contexts. A review of 10 qualitative investigations supported the usefulness of the "*Patient–Professional Partnership Model*" on clients' capability to self-manage chronic back pain (Fu et al., 2016). Similarly, a meta-synthesis found that partnership models could be beneficial to establishing self-care management in chronic illness (Rees & Williams, 2009). Also, an integrative review supported using the "*Nurse-Family Partnership Model*" as a part of family-centered care to promote the developmental outcomes and well-being of seriously ill children (Tallon et al., 2015). Moreover, a recent meta-analysis of five studies, performed in Germany and the United States, indicated that the "*Primary Care Provider–Case Management Partnership Model*" was the best model for post-diagnostic dementia care, and it had substantial consequences on distress and neuropsychiatric symptoms compared to usual primary care; however, no significant between-group difference was reported regarding QoL and depression (Frost et al., 2020). Considering the differences in clinical conditions and features of the implemented models in the current study and the mentioned reviews, results should be cautiously compared.

The beneficial effects of the PCM can be attributed to some components of this model. The concepts of "lack of clients' commitment to therapy," "clients' inappropriate perception of the character and consequences of the illness," and "ineffective care relation" are the fundamentals of the PCM. Based on this model, the persistence and complexity of chronic diseases are not exclusively linked to their physiological character; instead, they are related to the three concepts mentioned above that are obvious in most chronic diseases. Therefore, the following three elements are emphasized in the PCM to promote patients' health substantially: 1) establishment of continuous and interactive care relationships between the members of the partnership team to fix patients' health concerns, 2) training the patient unit via "training partnership visits" with attention to their educational needs, and 3) follow-up of the patient unit via "follow-up partnership visits" for evaluating

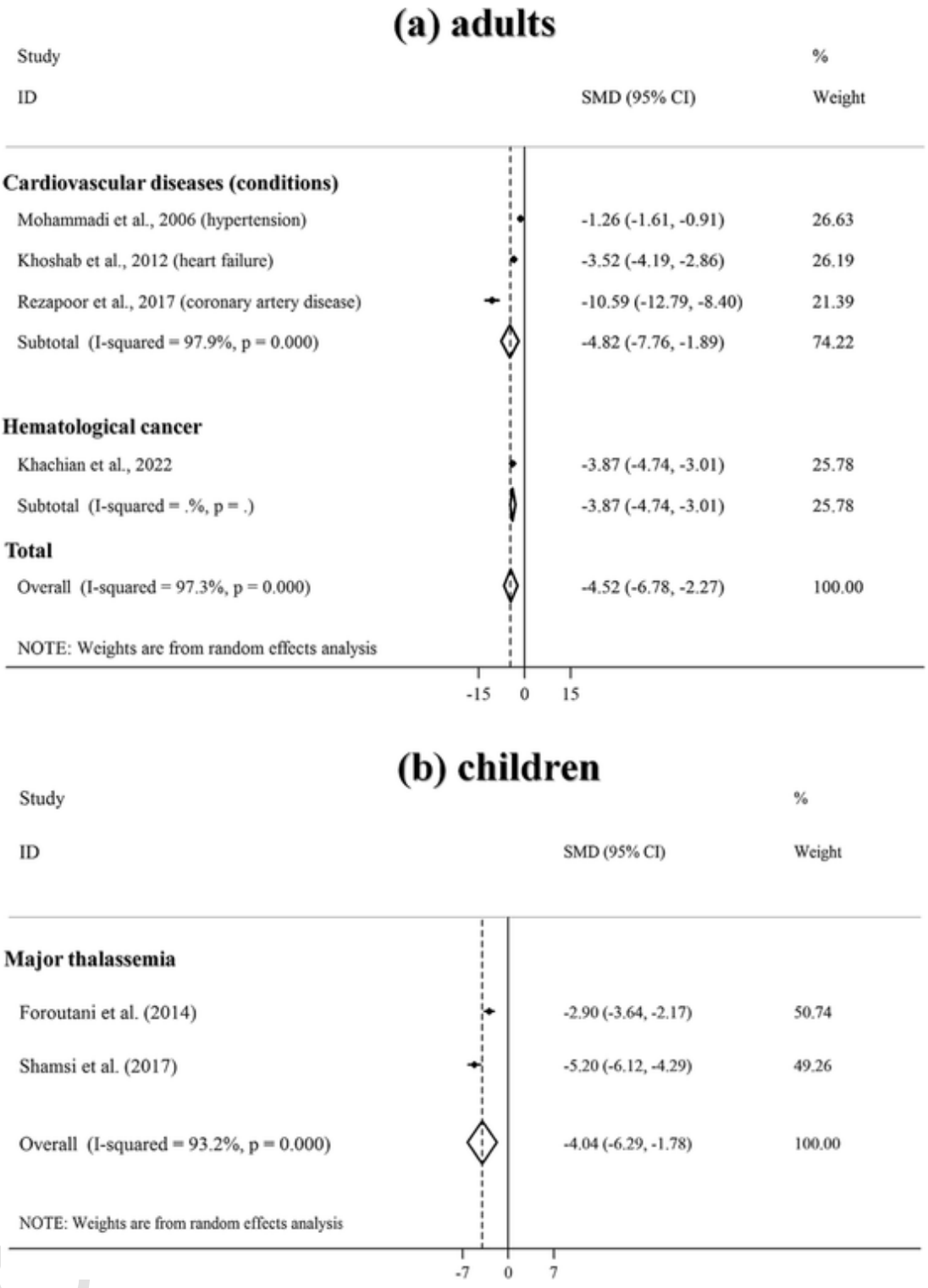

Fig. 4. Effect of the "*Partnership Care Model*" on anxiety among Iranian chronically ill adults (a) and children (b) (note: data are presented based on the clinical conditions).

the continuity of caring programs (Mohammadi et al., 2002). Enabling and empowerment are other PCM concepts that can effectively improve patients' health (Rahimi-Bashar et al., 2020).

4.1. Implications for practice

Implementing the PCM resulted in an increase in the adults' QoL (3.17 units), children's QoL (4.45 units), and adults' sleep quality (7.15 units). Also, the PCM-based interventions led to a substantial reduction in adults' anxiety (4.52 units), children's anxiety (4.04 units), and children's depression (7.99 units). Moreover, the interventions can non-significantly decrease adults' depression (7.66 units). Generally, a more-than-0.8-unit increase or decrease in outcomes represents a large magnitude of the mean difference (Cohen, 1988). Hence, the PCM could be considered as an efficacious context-based model for chronic diseases in different Iranian communities. This model can also help con-

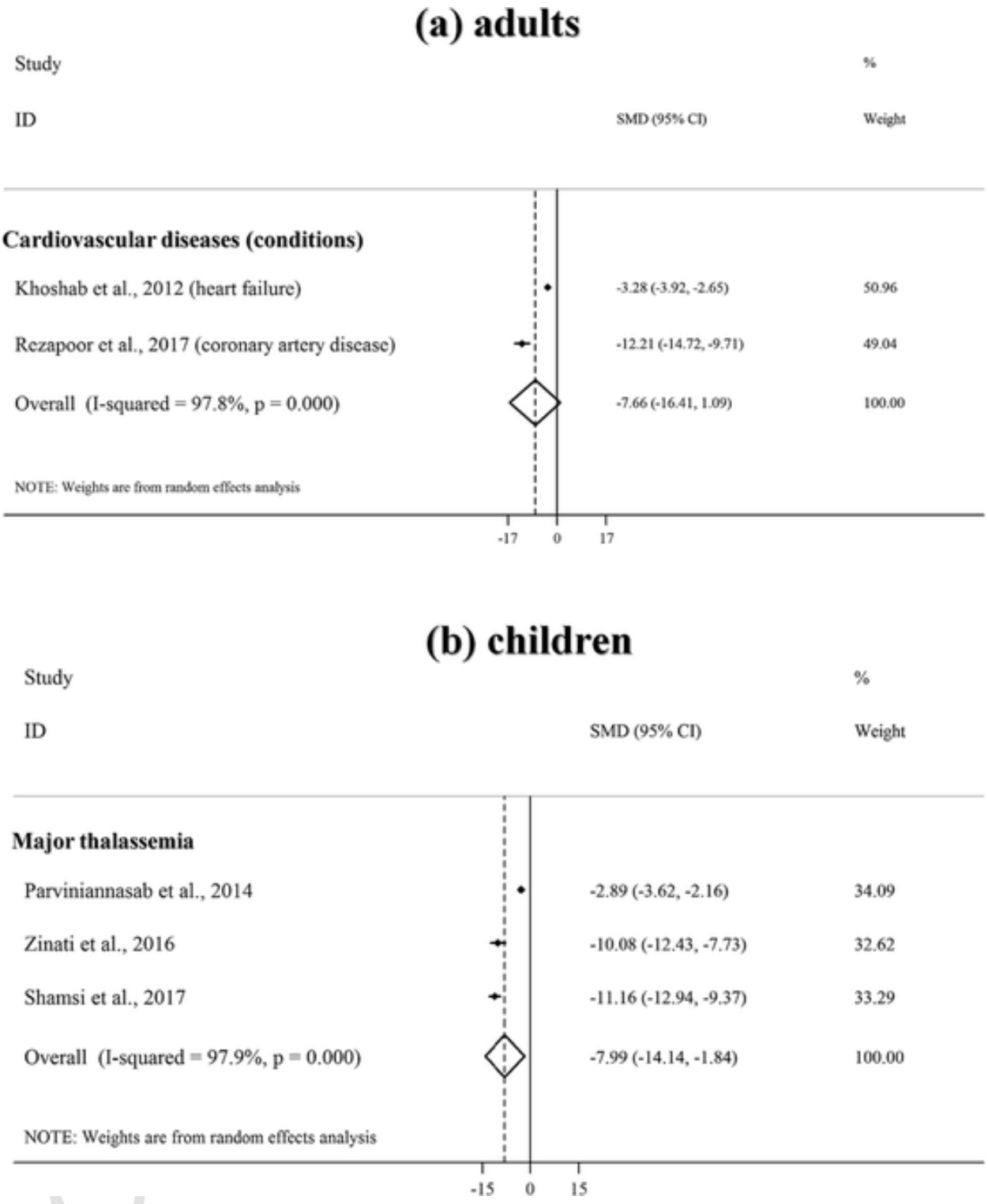

Fig. 5. Effect of the "*Partnership Care Model*" on depression among Iranian chronically ill adults (a) and children (b) (note: data are presented based on the clinical conditions).

centrate on patients as a whole rather than only the illness. Thus, a holistic caring strategy can be applied, as represented by Martha Rogers' theory (McEwen & Wills, 2017).

4.2. Directions for further research

The present review's findings can assist researchers in designing and evaluating new practical interventions based on the PCM. One finding of this study was the need for well-designed RCTs. According to the Cochrane ROB instruction, all investigated RCTs had an undesirable quality. The risk of selection bias was feasible in all studies because of the unclear details regarding allocation concealment. Additionally, most RCTs had yet to report the masking of the outcome assessors or participants, which might lead to overestimating the intervention effects. Moreover, according to the GRADE, the evidence was of low quality for all outcomes. The evidence was mainly downgraded because of

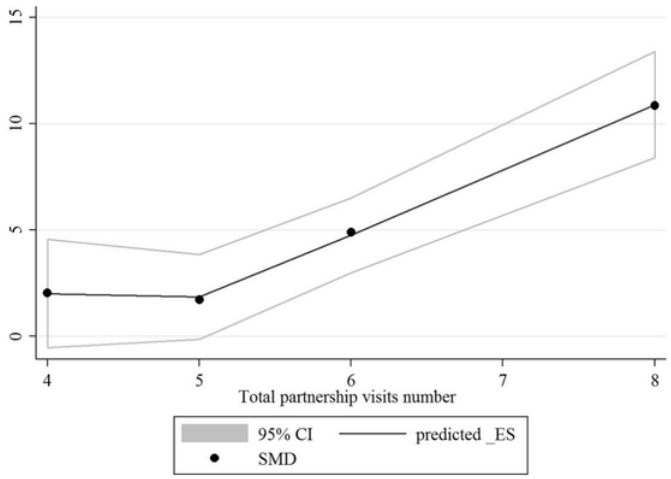

Fig. 6. Dose-response analysis for the association between the total number of partnership visits and changes in the quality of life of Iranian chronically ill children.

the ROB, inconsistency, and publication bias. Accordingly, it is of value to perform further RCTs with minimized ROB and enhanced methodological quality, as well as to report the completed trials more clearly and comprehensively.

Another noteworthy finding of this review was evaluating the duration and number of partnership visits that should be implemented to bring positive effects. The included RCTs used different numbers and durations of partnership visits. Subgroup analysis indicated the more meaningful impact of the PCM on the improvement of the adults' QoL in the RCTs that implemented ≤6 partnership visits for ≤350 min and ≤56 days. It also significantly impacted the reduction of adults' anxiety when the partnership visits were administrated for ≤315 min and ≤5 days. Nonetheless, the interventions led to a more considerable boost in children's QoL when the partnership visits were implemented for ≥6 sessions. Similarly, based on the dose-response analysis, implementing partnership visits with lower sessions could increase children's QoL to a lesser extent. For other cases, no significant dose-response association was found, which could be justified by the low variation in the number and duration of partnership visits. Therefore, future studies are urged to investigate the impacts of the PCM with different durations and numbers of partnership visits on the evaluated outcomes.

4.3. Study strengths

We broadly searched diverse data sources in the present review to discover all available studies. Thus, more ESs were pooled for QoL compared to a previous meta-analysis (KhoshFetrat et al., 2023), which skipped some pertinent studies. Likewise, we obtained more studies regarding the consequences of PCM on anxiety, sleep quality, and depression, making it possible to perform a pooled analysis for these outcomes for the first time. The present review is also the first dose-response meta-analysis sought to propose the standard number and duration of partnership visits that must be considered to achieve maximum results. Unlike earlier reviews that mixed the results of RCTs and quasi-experimental studies in their synthesis, we only included RCTs to present more accurate results. Likewise, children and adults were study participants in the current review, and data were analyzed separately for each age group, which was dismissed in previous reviews. Besides, we applied GRADE to assess the evidence quality, whereas previous reviews did not address the quality of evidence.

Table 2
GRADE evidence profile: The "*Partnership Care Model*" compared to routine care for Iranian adults and children with chronic diseases.

Outcomes (age group, number of studies)	Quality assessment					Summary of findings			
	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Number of participants		Effect (95 % CI)	Quality of evidence
						PCM	Routine care		
Quality of life (adults, 10 RCTs)	Serious[b]	Serious[c]	No serious[d]	No serious[e]	Strongly suspected[f]	379	379	SMD: 3.17 higher (1.93 higher to 4.42 higher)[g]	⊕⊕⊖⊖ Low[h]
Quality of life (children, 4 RCTs)	Serious[b]	Serious[c]	No serious[d]	No serious[e]	Strongly suspected[f]	116	116	SMD: 4.45 higher (2.33 higher to 6.56 higher)[g]	⊕⊕⊖⊖ Low[h]
Quality of sleep[a] (adults, 3 RCTs)	Serious[b]	Serious[c]	No serious[d]	Serious[i]	Undetected	86	86	WMD: 7.15 higher (4.91 higher to 9.39 higher)[g]	⊕⊕⊖⊖ Low[h]
Anxiety (adults, 4 RCTs)	Serious[b]	Serious[c]	No serious[d]	No serious[e]	Strongly suspected[f]	175	175	SMD: 4.52 lower (6.78 lower to 2.27 lower)[g]	⊕⊕⊖⊖ Low[h]
Anxiety (children, 2 RCTs)	Serious[b]	Serious[c]	No serious[d]	Serious[i]	Undetected	71	71	SMD: 4.04 lower (6.29 lower to 1.78 lower)[g]	⊕⊕⊖⊖ Low[h]
Depression (adults, 2 RCTs)	Serious[b]	Serious[c]	No serious[d]	Serious[i]	Undetected	70	70	SMD: 7.66 lower (16.41 lower to 1.09 higher)[g]	⊕⊕⊖⊖ Low[h]
Depression (children, 3 RCTs)	Serious[b]	Serious[c]	No serious[d]	Serious[i]	Undetected	91	91	SMD: 7.99 lower (14.14 lower to 1.84 lower)[g]	⊕⊕⊖⊖ Low[h]

Abbreviations: CI, confidence interval; PCM, partnership care model; RCTs, randomized controlled trials; SMD, standard mean difference; WMD, weighted mean difference.

[a] Of three studies on sleep quality, none was conducted among children.
[b] Higher percentage of risk of bias items across studies was unclear.
[c] I-squared statistic (I^2) > 95 %.
[d] Studies were sufficiently directed related to population, intervention, comparator, and outcome of interest.
[e] The boundaries of the confidence interval include the overall treatment effect, but the optimal information size is met.
[f] Begg's rank and Egger's regression tests ($P < 0.05$).
[g] Large magnitude of effect.
[h] This evidence provides some indications of the likely effects. However, the likelihood that it will be substantially different** is high (**substantially different: a large enough difference that may affect a decision).
[i] The boundaries of the confidence interval include the overall treatment effect, and the optimal information size is not met.

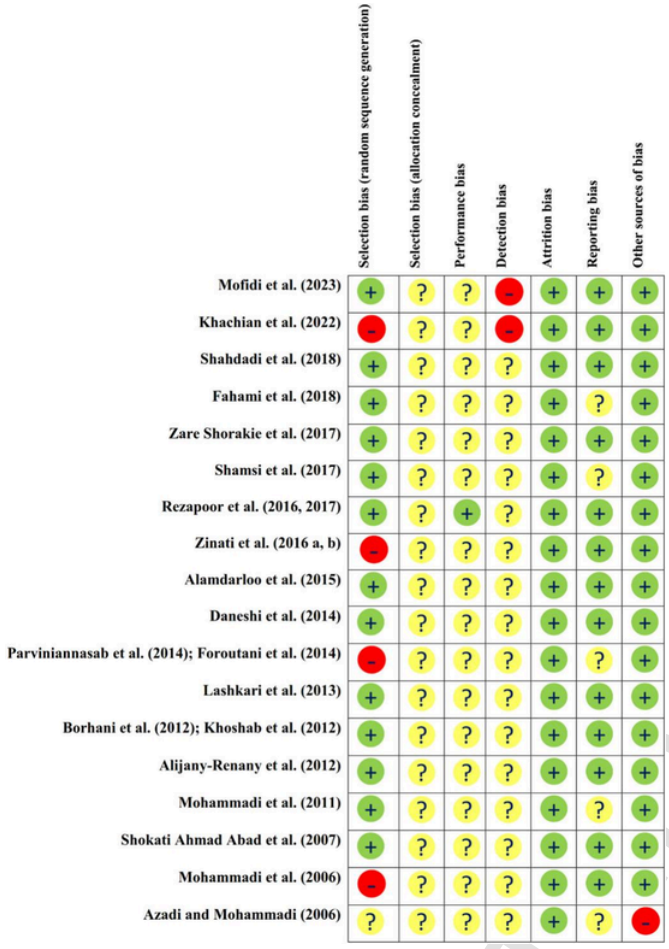

Fig. 7. Summary of the authors' judgments about the risk of bias items within studies.

4.4. Study limitations

Some limitations should be taken into account when interpreting the present review's findings. First, a random-effects approach was employed to consider variations among studies. Yet, a high heterogeneity was discovered between studies in the principal analysis. Although some variables were determined as the potential heterogeneity sources based on subgroup analyses, the heterogeneity might result from the variations in other possible variables, about which no details were known. Second, conducting supplementary analyses (i.e., meta-regression, dose-repose, subgroup) was impossible in some cases due to unclear information about the number and duration of partnership visits or the limited number of pooled ESs. Although the corresponding authors asked for more details on unknown data, no response was obtained in some cases, and estimations were made according to the current study investigators' consensus. Third, the low evidence quality and unsatisfactory methodology quality of included RCTs make it impossible to draw an accurate evidence-based conclusion about implementing the PCM for adults and children with chronic diseases to manage their health outcomes.

5. Conclusions

This meta-analysis suggested the benefits of implementing care programs based on the PCM for Iranian adults and children with chronic conditions. The findings indicated that the PCM could potentially improve adults' and children's QoL, boost adults' sleep quality, reduce adults' and children's anxiety, and alleviate children's depression. Nevertheless, the intervention had a non-significant but favorable impact on adults' depression. Besides, this study revealed a need for more high-quality RCTs to generate a higher quality of evidence. Forthcoming investigations are suggested to compare various numbers and durations of partnership visits to fully understand the exact number and the optimal duration of partnership visits that must be implemented to bring the most remarkable effects on the study outcomes. Moreover, researchers are recommended to depict the whole process of PCM implementation from the onset to the end more vividly by presenting the exact details of the number and duration of partnership visits.

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Ethical confirmation

This review was approved by the Regional Research Ethics Committee of Abadan University of Medical Sciences, Abadan, Iran (approval No. IR.ABADANUMS.REC.1400.014).

Review registration

This review was registered in the International Prospective Register of Systematic Reviews (PROSPERO) with the registration No. CRD42021253790.

CRediT authorship contribution statement

MN: study conception and design, data analysis, data interpretation, and manuscript preparation and revision; FY, SZ: study conception and design, data interpretation, and manuscript revision; MNB, ZJ: study search, data analysis, data interpretation, and manuscript revision; MA, MSAN, MBK: study selection, data extraction, and manuscript revision; MT, MRR, MR: assessing the risk of bias and the quality of the evidence, data interpretation, and manuscript revision; MA: study conception and design, data analysis, data interpretation, and manuscript revision. All authors approved the final manuscript for submission.

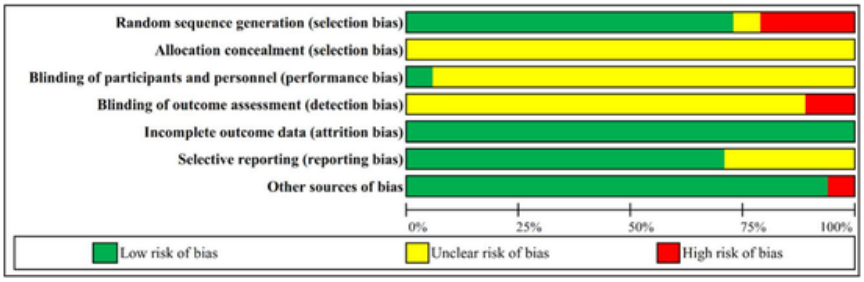

Fig. 8. Summary of the authors' judgments about the risk of bias items across studies.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability statement

The data supporting this study's findings are available from the corresponding author upon reasonable request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.apnr.2023.151744.

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