

Investigating the Effective Factors on Implementation of World Health Organization Package of Essential Non communicable Disease Interventions for Primary Health Care in Low Resource Settings: A Scoping review

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Abstract

Background/objective:

Due to the widespread prevalence of non-communicable diseases, the World Health Organization has designed a package of essential interventions for non-communicable diseases for primary health care in low-resource settings. This study aimed to investigate the factors affecting the implementation of the WHO PEN for primary health care in low-resource settings.

Materials and Methods

This research was conducted through a five-step process of scoping review. We first searched for the keywords Noncommunicable Diseases, NCD, WHO PEN, PEN and other synonyms for these words to find the suitable analytical studies in databases including PubMed / MEDLINE, Scopus Cochrane Library, Web of Science, Google Scholar. The articles were then selected based on the PRISMA 2009 Flow Diagram. Finally, to analyze the content from the results section of the selected articles, we used the framework analysis method to extract the study implementation outcome and the factors affecting it.

Results

A total of 26 articles were included. Most articles are from 2016 to 2018. Most of the articles were cross-sectional and most studies evaluated the outcomes of Appropriateness and Feasibility. Identified effective factors include target population coverage, staff training, patient motivation, patient follow-up, and observance of PEN protocols.

Conclusion

Using this study, policymakers and managers of the health system will be able to implement this package (WHO PEN) more successfully.

Background

One of the challenges facing the health system in the world is the widespread prevalence of non-communicable diseases. The prevalence of non-communicable diseases is a global crisis. As predicted by 2020, 60% of diseases and 73% of all deaths are expected to be related to non-communicable diseases(1). These diseases can be controlled by identifying risk factors and primary prevention. In 2013, the World Health Organization (WHO) designed a set of priority and effective interventions at the primary health care level in the form of a package of essential interventions for non-communicable diseases for primary health care to address the current challenge(2).

This package is an innovation and action-based response to existing challenges that is a set of priority and cost-effective interventions that can provide quality care even in the face of low resources. The package's main protocols include prevention of heart attacks, strokes and kidney disease through integrated diabetes and blood pressure care, health education and counselling on healthy behavioural diseases, asthma management, chronic obstructive pulmonary disease, and the evaluation and referral of women with suspected the lungs and uterus cancer(2). The purpose of such a package is to provide a fair framework for initiating the development of primary care because countries are working to achieve public access to health care. Therefore, WHO PEN should be an integral part of health care programs for the benefit of the poor, targeting vulnerable and disadvantaged groups. It should not be used as a means for care rationing in places where health care investment is insufficient despite existing resources due to poor management and leadership. As noted, the package should be considered as the minimum standard and only as a starting point for addressing NCDs in primary health care in low-resource settings(3). WHO PEN implementation increases national capacity to integrate and improve primary health care interventions for heart

disease, stroke, cardiovascular risk, diabetes, cancer, asthma, and chronic obstructive pulmonary disease in low-resource settings(4).

The feasibility of implementing the high blood pressure and diabetes management protocol in the community-based prevention and control project was tested in China from April 2013 to August 2014. More than 2,000 primary care physicians from 200 public health centres in eight regions attended training sessions based on the WHO PEN protocol. Initial analysis of data from a screening of 300,000 People showed that awareness, treatment, and control of hypertension during project implementation were continuously improved and the risk of cardiovascular disease was reduced. At the same time, doctors have increased their skills in implementing the WHO PEN protocol in practice. The project showed that the WHO PEN would be particularly suitable for primary health care physicians in China(4).

A study conducted in Nepal following the implementation of the Non-Communicable Diseases Intervention (PEN) package for primary health care in low-resource settings revealed that the implementation of this PEN package provides opportunities to strengthen the workforce, diagnosis, medication and equipment, and health information system and research and monitoring and reducing inequality in diabetes care in Nepal, and the current state of health care facilities for the implementation of PEN has been assessed as satisfactory(5). In another study in Ghana, healthcare facilities lacked the capacity needed to properly implement WHO-PEN intervention. The results also highlight the lack of access to essential medicines needed to adequately manage NCDs at different levels of care(6). Another study, by assessing the facilities of eight LMIC countries, identified major shortages in financing, access to essential technologies and medicines, medical information systems, and the health care workforce(7). Another study was conducted to identify gaps and challenges in integrating diabetes care according to the WHO PEN protocol in Myanmar. The results show that the implementation of this protocol requires policy development for essential medicines and equipment, capacity building of health care workforce and referral system and appropriate health information system(8).

We define the outcomes of implementation in the present study as the effect of conscious and purposeful actions to implement new treatments, procedures and services. Implementation outcomes have three important functions. First, they act as indicators of implementation success. Second, they are approximate indicators of implementation processes, and third, they are key intermediate results about the service system or clinical outcomes in the effectiveness of treatment and the quality of care research. Since without successful implementation, intervention or treatment will not be effective. , the outcomes of its implementation will be used as a prerequisite for achieving the desired changes in clinical or service outcomes(9).

Since limited and scattered research has been conducted both in terms of outcomes and in terms of the type of implementation of the study, as well as the factors influencing the implementation of this package, and given the fact that the results of the science of implementation can improve routine health care in countries and communities with low resources, and the need for such results is certainly higher than in rich countries. In the present study, to achieve the predetermined goals of this WHO PEN program and to evaluate the implementation of its protocols, we intend to conduct a scoping review of the factors affecting the outcomes of implementation (Acceptability of the intervention, Adoption, Appropriateness, Cost, Feasibility, Fidelity, Penetration, Sustainability) of the Non-Communicable Diseases Intervention Package (WHO PEN) based on the conceptual framework expressed by Proctor et al(9) and identify and investigate the impact of interventions in the prevention of non-communicable diseases in setting with low resources.

One of the potential advantages of the scoping review is that it can provide an accurate and clear map of the areas of research(10). This study, in turn, makes it possible to identify gaps in the evidence base as well as to summarize and disseminate research findings. By providing results in an accessible and concise format, policymakers, stakeholders, and users to make effective use of the findings are in a better position.

Methods

In this study, using the five-step process of Arksey and O'Malley framework for scoping review, we investigated and identified the factors influencing the implementation of non-communicable disease intervention package for primary health care in

settings with low resources(11). These steps include: identifying the research question, identifying the relevant studies, selecting the study, charting the data, and finally collecting, summarizing, and reporting the results. According to the framework of the scoping review used, our approach is similar to a narrative review that takes a broader view and Finally, the results are documented and is more comprehensible to readers.

In the first step, the research question, which Investigated the factors affecting the implementation of the package of non-communicable diseases interventions for primary health care in environments with limited resources, was identified. In the second step, which is to identify the relevant studies, we first searched for keywords Noncommunicable Diseases, NCD, WHO PEN, PEN and other synonyms for these words to find suitable studies for analysis in databases including PubMed / MEDLINE, Scopus, Cochrane Library, Web of Science, Google Scholar.

In the third step, according to the inclusion criteria, including the structure of articles that have been evaluated based on the implementation of the Non-Communicable Diseases Intervention Package (WHO PEN) for primary health care, and the results achieved in each of the intended study implementation outcomes(Acceptability of the intervention, Adoption, Appropriateness, Cost, Feasibility, Fidelity, Penetration, Sustainability) between 2010, the time of the publication of the package (WHO PEN), until 2019, it was investigated and articles that did not meet the following criteria were excluded from the study: articles that were not in English, Articles that investigated other aspects of the package other than its implementation, articles that were not researched, articles that were not on a human subject. The researchers separately evaluated all related articles to classify studies according to inclusion criteria. Any discrepancies are discussed and a consensus was reached.

In the fourth step, the data of the selected articles were entered in the Excel database program. The content of data chart forms includes the following: author, year of publication, place of study, methodology, study objectives, important results that were identified and tabulated from selected articles. The data diagram was extracted to typology the articles using the Excel database software program. In the last step, according to the fifth step, Arksey and O'Malley framework for scoping review, for content analysis from the results section of selected articles, We used the framework analysis method to derive the outcome of implementation of the intended study and the factors affecting it.

In this study, we used a conceptual framework proposed by Proctor et al to synthesize the results and to understand the implications of implementation outcomes(9). In this model, a variety of outcomes in implementation research including Acceptability of the intervention, Adoption, Appropriateness, Cost, Feasibility, Fidelity, Penetration, Sustainability are introduced. The Proctor Framework was identified as the most appropriate conceptual framework for guiding the overall design of our study, as it was specifically developed to assess implementation activities in the field of healthcare(12). As shown in Figure 1.

Results

A total of 408 articles were extracted. Search results were saved from each database in EndNote X9 and duplicate articles were removed, Finally, 354 articles remained. In the next step, by checking the titles and abstracts of the articles, they were screened based on the inclusion and exclusion criteria of the articles, as a result of which 318 articles were removed and 36 articles remained. In the last step, by reviewing the full text of the articles, 26 articles were found for the final review. Figure 2 shows the steps for selecting articles based on the PRISMA 2009 Flow Diagram. After reading all the selected articles, the authors summarized the data of the selected articles based on Table 1. (As Table1 larger than one Letter page in length is placed at the end of the document text file.)

This program (WHO PEN) is designed for countries with a shortage of resources (LMIC). WHO member states are classified as low- and middle-income countries (LMICs) (6 WHO regions are used), and high-income countries divide each of these regions into a seventh group. Out of a total of 26 studies, one study is from 8 LMIC countries. Most of the studies are on Bhutan. A total of 18 single-country studies have been conducted. Most of the articles were published in 2016, 2017 and 2018. The most common type of article is among the 26 selected articles, cross-sectional survey articles with 9 articles and Commentary, perspective articles.

Based on the conceptual model of the present study, articles related to each of the factors affecting the implementation of the Non-Communicable Diseases Intervention Package (WHO PEN) for primary health care were identified and coded and categorized based on the outcomes of the implementation of the study (Acceptability of the intervention, Adaptation, Appropriateness, Cost, Feasibility, Fidelity, Penetration, Sustainability). Some studies, such as feasibility studies, have explicitly described and evaluated that aspect of the implementation factors that are feasibility. However, in some articles, by reading the full text and the questions and results obtained, based on the analysis of the framework, the desired outcome that the study sought to evaluate was extracted. Of the eight study outcomes, 6 outcomes were evaluated based on the articles, including Adaptation, Appropriateness, Cost, Feasibility, Fidelity, and Penetration, most of which evaluated the Appropriateness outcome. Finally, the factors affecting the implementation outcomes that were evaluated in each article were extracted and included in the subset of 4 categories include individual factors affecting the implementation of the program, factors related to the program, factors related to the organizational field, factors related to the external field. The classification of effective factors is based on the 4 categories mentioned in Table 2. The effective factors based on each of the outcomes of implementing the WHO PEN program are described below.

Adoption

Adoption refers to the proportion and representation of areas (such as worksites, health departments, or communities) that adopt a particular policy or program(34). Adoption is defined as the goal, initial decision, or action to attempt or apply evidence-based innovation or action(35). Adaptation means "the process of creating a program to create as much as possible for a particular population or organization, based on its capacity. Change in a program must be done without compromising or destroying the core components of the program"(36), is defined. In this study, we outlined adaptation is one of the outcomes: In a study conducted to strengthen the relationship between health care and community services in Samoa, the word adaptation was used to assess the level of acceptance and coverage of the population. This program was covered(14) based on the definition of Adaptation, it was decided to include this article as an article on the Adaptation aspect in the Adoption group. Factors influencing the outcomes of adaptation include a focused community-based approach, monitoring the progress of intervention over time using data management, providing screening results to the community, and raising awareness of the nature of the early stages of NCDs.

Appropriateness

Appropriateness is the perceived fit, relevance, or adaptability of innovation or evidence-based action to a set of activities, provider, or consumer, or understanding of innovation to address a particular issue or problem. "Appropriateness" is conceptually similar to "acceptance," and literature, when discussing these structures, shows overlapping and sometimes contradictory terms (9).

In this study, a total of 10 articles are related to this type of outcome. Examining these articles, the factors influencing the outcome of "Appropriateness " include individual factors such as more accurate physical examination by a physician, more time with a physician, a better understanding of medication prescription, patient adherence to monthly visits to the intervention group due to advanced patient education, messaging SMS and components of telephone reminders, patient motivation, health education messages.

Organizational factors were such as availability of necessary equipment and medicines, referral systems, use of monitoring tools, training of rural health workers, lack of time, lack of staff, shorter waiting time, use of a time-setting system, no increase the follow-up period between visits, the importance of the division of labour, simple workflow, health information and research system, the existence of supportive technologies, Informed and supportive managers, recording basic demographic and clinical information, capacity building for health system research and training, better organization of testing Laboratory.

Program factors were identified such as patient follow-up, clinical trials, PEN Operations Manual, population coverage, accurate patient data recording, the changes measurement in population and not in patients, encouragement and follow-up of patients via mobile phones and Home visits, physician use of risk prediction charts and scores, training for newcomers, lifestyle counseling, intervention quality maintenance, target population coverage, opportunistic screening, evidence-based interventions, Complications monitoring, clear referral criteria and Participatory health care services, regular blood pressure measurements, Waist circumference and weight, Multilateral and frequent training, maintaining the quality of the intervention, regular approaches to identifying the target population and achieving coverage, engaging patients, the importance and priority of staff training to assess CVD risk, supporting the use of CVD risk charts as a communication tool, Expanding risk scoring on a larger scale, individual counseling, and the entire risk-based CVD algorithm.

External and environmental factors were identified such as budget allocation in annual programs, communication with local physicians, targeting public health myths in the community, barriers to access to patients such as distance and complex travel.

Cost

The cost of implementation is defined as the cost of an executive effort. Implementation costs vary according to the three components. First, because the Treatments are very different in terms of their complexity, the cost of providing them will be different. Second, the cost of implementation will vary depending on the complexity of the specific used implementation strategy. Finally, because the treatments are performed with different areas and complexities (from the individual physician's workplace to a third-level care centre), the overall cost of providing services in each area will vary. Therefore, the actual cost of implementing a treatment depends on the cost of the particular intervention, the strategy used, and the location of delivering services(9). In the present study, 3 articles have done an economic evaluation of the "WHO PEN" program. The results of two studies confirmed the cost-effectiveness of the WHO PEN program. In another study that was compared the program to another program in terms of cost-effectiveness, WHO PEN was less cost-effective. Factors influencing the outcome of the "cost" identified in these studies include the justification of widespread and common treatment, the Utilization of a specific population deprived of treatment, the prioritization of risk factors, the explicit and clear focus of guidelines on justice, significantly high population coverage under treatment, screening public health as a priority for the spread of screening, the prevalence of the disease, the falling rate of the relative risk of death from kidney disease, and The relative risk of death from controlled and uncontrolled blood pressure.

Feasibility

Feasibility means how can be successful a new treatment or innovation in an agency or a specific location and using (37). In the present study, most of the articles based on WHO PEN Tool measured the capacity and readiness of health care centres to implement the program in five areas including basic equipment, essential services, diagnostic capacity, counselling services and essential medications(2). Identified effective factors include the effectiveness of WHO PEN tools for ranking center performance, the effectiveness of WHO PEN tools to achieve NCD goals and prioritization, staff training, equipping centers, the availability of essential drugs, and the provision of quality services, Adequate training and skills in the use of some intervention technologies for early diagnosis and diagnosis, the existence of clear guidelines and policies to include promotion and prevention actions, the availability of basic equipment, basic diagnostic tests, medication and access to referral centers and medical records, Medical Information Management System, continuous and periodic monitoring of the capacity of centers during time, frequent monitoring and measurement of indicators of delivering medical services, the importance of scale up low cost and effective interventions, strengthening the capacity of health workers, access to basic technologies and essential drugs, training and empowerment of non-physician health workers, removing barriers to continued care By strengthening the medical information system, low quality of service due to lack of sufficient financing, the ability of family physicians to implement protocols and risk assessment, increasing people's awareness, screening, patient follow-up, free medication from nearby healthcare centers, regular consumption of Medications.

Fidelity

Fidelity is defined as the extent to which an intervention is performed as intended in the original protocol or as intended by program developers(38). In this study, only one article was identified to evaluate this outcome. In this article, the observance of WHO PEN protocols by staff is measured by reviewing files in health centres. The only effective factor is the degree of matching of data entry in the file, as well as the actions and follow-ups performed by the staff according to the WHO PEN program protocols.

Penetration

"Penetration" is defined as the integration of an action into a service setting and its subsystems(9). In this study, 3 articles evaluated this outcome of implementation. The most important factors identified in these articles include the commitment of the highest administrative authority, strong leadership of the Ministry of Health, integration of policymaking and services delivery, a coordination mechanism, cooperation of women representatives as community health workers, integration of national policies on NCDs in national health policy and development of a strategic action plan with national goals by global and regional voluntary goals, strengthening the multi-sectoral coordination mechanism, emphasizing the production of qualified human resources for healthcare delivery focusing on the quantity, quality and categories required by the health workforce.

Table 2. the Effective Factors on Implementation of WHO PEN

Organizational factors	Program factors	individual factors	External and environmental factors
<p>Resources (human and material):</p> <ul style="list-style-type: none"> - Reuse and rehabilitate existing manpower - staff training - Adequate training and skills in the use of some intervention technologies for early diagnosis and diagnosis strengthening the capacity of health workers - Informed and supportive managers - emphasizing the production of qualified human resources for healthcare delivery focusing on the quantity, quality and categories required by the health workforce - the availability of basic equipment, basic diagnostic tests, medication - capacity building for health system research and training <p>Technology:</p> <ul style="list-style-type: none"> - Existence of supportive technologies - Medical information management system - recording basic demographic and clinical information - removing barriers to continued care By strengthening the medical information system <p>Culture :</p> <ul style="list-style-type: none"> - Participatory health care services <p>Structure:</p> <ul style="list-style-type: none"> - better organization of testing Laboratory. - access to referral centres and medical records - the importance of division of labour - simple workflow - a coordination mechanism - shorter waiting time - use of a time-setting system 	<p>Training and counselling:</p> <ul style="list-style-type: none"> -Multilateral and frequent training, -training for newcomers -individual counselling -lifestyle counselling -PEN Operations Manual Screening -providing screening results to the community -opportunistic screening -Global screening -priority for the spread of screening <p>the quality of service:</p> <ul style="list-style-type: none"> -provision of quality services -maintaining the quality of the intervention -low quality of service due to lack of sufficient financing -Observance of WHO PEN protocols by health workforce -the ability of family physicians to implement protocols and risk assessment -priority of staff training to assess CVD risk -supporting the use of CVD risk charts as a communication tool -Expanding risk scoring on a larger scale -evidence-based interventions -the prioritization of risk factors 	<ul style="list-style-type: none"> -the justification of widespread and common treatment -patient adherence to monthly visits to the intervention group due to advanced patient education, messaging, SMS and components of telephone reminders -a better understanding of medication prescription -more accurate physical examination by a physician -patient motivation -increasing people's awareness -health education messages -free medication from nearby healthcare centres -regular consumption of Medications. -engaging patients -more time with a physician -raising awareness of the nature of the early stages of NCDs. 	<ul style="list-style-type: none"> -the commitment of the highest administrative authority - strong leadership of the Ministry of Health -integration of national policies on NCDs in national health policy and development of a strategic action plan with national goals by global and regional voluntary goals -strengthening the multi-sectoral coordination mechanism -the prevalence of the disease -communication with local physicians -Consequences of EML National Selection on Population Access to Drugs -Review and update governments on their ELMs -budget allocation in annual programs -cooperation of women representatives as community health workers -targeting public health myths in the community. -barriers to access to patients such as distance and complex travel -integration of policymaking and services delivery -a focused community-based approach -the existence of clear guidelines and policies to include promotion and prevention actions -Linking the work of community health workers with government employees Health facilities in villages and districts -access to basic technologies and essential drugs -the explicit and clear focus of guidelines on justice

	<p>Patient follow-up</p> <ul style="list-style-type: none"> -encouragement and follow-up of patients via mobile phones and Home visits -No increase the follow up period between visits <p>Monitoring and evaluation:</p> <ul style="list-style-type: none"> - continuous and periodic monitoring of the capacity of centres during time - frequent monitoring and measurement of indicators of delivering medical services - monitoring the progress of intervention over time using data management - the measurement of the changes in population and not in patients - Complications monitoring <p>target population coverage</p> <ul style="list-style-type: none"> -regular approaches to identifying the target population and achieving coverage -the Utilization of a specific population deprived of treatment, -clear referral criteria and -accurate patient data recording 		
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Discussion

This scoping review was conducted to investigate the effective factors the implementation of world health organization package of essential non-communicable disease interventions for primary health care in low resource settings. 26 articles came into our study, each evaluating the outcomes of implementation. The most common type of article includes cross-sectional study articles. Out of a total of 26 studies, one study is from 8 LMIC countries. Most of the studies are on Bhutan. A total of 18 single-country studies have been conducted. Most articles were published in 2016 to 2018.

World health organization package of essential non-communicable disease interventions for primary health care in low resource settings (WHO PEN) to activate early diagnosis and management at the primary care level in low-resource settings. WHO PEN is a set of prioritized cost-effective interventions that can provide an acceptable quality of service at a low cost. These interventions have the minimum standards for non-communicable diseases, strengthening national capacity to integrate and expand care for heart disease, stroke, risk of cardiovascular disease, diabetes, cancer, asthma and chronic obstructive pulmonary disease in primary health care in low-resource settings(3). Therefore, in the present study, we tried to get a comprehensive view of the studies that evaluated the implementation of this package. In this regard, we used the conceptual framework of implementation of Proctor et al. Of the eight study outcomes, 6 were evaluated based on articles, including Adaptation, Appropriateness, Cost, Feasibility, Fidelity, and Penetration, and most of the articles were evaluated for Appropriateness. None of the studies evaluated the outcome of Acceptability and Sustainability.

Acceptability should be assessed based on the stakeholder's knowledge or direct experience with the various dimensions of the treatment to be performed, such as its content, complexity, or comfort. Acceptability differs from the broader structure of service satisfaction; satisfaction is typically measured through consumer surveys. Acceptability is more specific, referring to a specific treatment or set of treatments, while satisfaction typically refers to the experience of public services, including features such as waiting time, planning, and environmental conditions. Acceptability may be measured from the perspective of different stakeholders, such as supervisors, payers, providers, and consumers(9). Therefore, according to the framework used in this study, there is a lack of study in the field of evaluating the acceptance or Acceptability of the program by the stakeholders of the program.

About Sustainability, Rabin et al(2008) emphasize the integration of a specific program in the culture of the organization through policies and practices and identify three steps that determine institutionalization: 1- Transition (a single event Such as transition from temporary to permanent budget), 2- cycle or routine (It means frequent reinforcement of the importance of evidence-based intervention by incorporating it into organizational or community practices and behaviours, such as annual budgets and evaluation criteria) and 3- niche saturation (The degree of integration of evidence-based intervention in all subsystems of an organization(35); In fact, Steckler et al(1992) emphasize sustainability in terms of achieving long-term durability as the final stage of the dissemination process in which innovations are established in organizations(39). Unfortunately, no study has been done in this scope.

Factors affecting the outcomes of implementing the WHO PEN program include four categories of factors related to the organizational context, individual factors, factors related to the program and factors related to the context and environment. In general, some of the most important factors related to the organizational context are strengthening the capacity of health workers, Informed and supportive managers, the importance of division of labour, a coordination mechanism, the use of a time-setting system, and so on. The most important factors related to the program are opportunistic screening, follow-up of patients, observance of WHO PEN protocols by employees, accurate recording of patient data, regular approaches in identifying the target population and achieving coverage, etc. One of the most important individual factors in the implementation of WHO PEN program is the patient's adherence to monthly visits to the intervention group due to advanced patient education, SMS messaging and telephone reminder components, patient motivation, increasing people's awareness, regular medication use. Commitment of the highest administrative official, strong leadership of the Ministry of Health, strengthening the multi-sectoral coordination mechanism, etc are effective factors resulting from the external environment. Quantitative studies have identified effective individual factors (such as program participants, stakeholders, etc.) and external factors.

Conclusions

The results of this study show that there are few studies on the outcomes of the implementation of this program. Since evaluating the implementation of a program is considered one of the evidence of success in the implementation of that program, therefore, according to this study, research design is recommended in terms of the outcomes that were not studied. The study also identified and explained the factors influencing the implementation of the program (WHO PEN) that facilitate the successful implementation of this program, or the obstacles to its implementation to support its successful implementation

in Primary healthcare requires that they be removed. Therefore, according to the effective factors identified in this study, policymakers and managers of the health system will be more successful in implementing this package (WHO PEN).

Abbreviations

WHO PEN; World Health Organization Package of Essential Non-communicable Disease Interventions; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; WHO: World Health Organization

Declarations

- **Ethics approval and consent to participate:**

Not applicable.

- **Consent to publish:**

Not applicable.

- **Availability of data and materials:**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

- **Competing interests:**

There are no competing interests to declare.

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- **Authors' contributions:**

MiA, AiA and NaS designed the study. MiA and AiA collected the data and performed the data analysis. All authors edited and revised the paper for grammar. All authors read and approved the final paper for publication.

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Table 1

Table 1. SUMMARY OF STUDIES INCLUDED IN THIS REVIEW

	Author(s) (publication year) Focus country	Sample / Type and method of article	Study Type	Study aims	Implementation outcome	results related to the research question
1	Baghirov et al. (2019) Samoa(13)	Commentary	Qualitative	To describe the important historical and cultural role of women in accelerating progress towards UHC	Penetration	Preliminary results of the program implementation are positive. PEN Fa'a Samoa achieved a high level of population screening coverage in the demonstration villages, in which the women's committee representatives played a key role. More than 90% of the target population has been screened for NCDs.
2	Caroline Bollars et al. (2018) Samoa(14)	N= 2234 adults/ The conceptual development of the three-step package took place from September to December 2014, and screening at the pilot sites occurred from February to March 2015.	Quantitative	strengthening links between health services and the community; and meeting the global target of at least 50% of eligible people receiving treatment and counselling through early detection and management of noncommunicable diseases	Adaptation	As a result of the Fa'a Samoa intervention package, those high-risk members of the population were made aware of their risk status and were motivated to seek treatment or manage risk factors. Village members learned about the risk of noncommunicable diseases at organized sessions, which brought villagers together and translated findings into their language and understanding. By being made aware that such diseases have no symptoms in their early stages, the cultural belief that illness is only present when a person feels ill was overcome.
3	Dorji et al. (2016) Bhutan(15)	Perspective	Qualitative	Presentation and review of Bhutan's experience in WHO PEN implementation and prevention and management of diabetes	Appropriateness	<ol style="list-style-type: none"> 1. The proportion of patients who were followed up was high, owing to the involvement of non-physician health workers, who also conducted home visits. 2. During the pilot in 2009, the implementation of PEN interventions led

						<p>to the identification of new NCD cases. On average, every month, each BHU registered five new patients and each hospital registered 15 new patients with NCD.</p> <p>3. opportunistic screening of those aged over 40 years resulted in the identification of patients with high blood pressure and high blood glucose.</p> <p>4. The PEN pilot project empowered primary health-care workers to extend screening, diagnosis, treatment and counselling services to patients with NCD, from a health facility close to their home.</p> <p>5. The availability of medicines free of cost and close to home, and counselling by health workers who were well known in the community, improved behaviours and encouraged the regular intake of medicines, which led to better control of high blood pressure and high blood glucose, thereby reducing the risk for cardiovascular disease.</p>
4	Mutale et al. (2018) Zambia(16)	N= in the three districts, A total of 46 primary health care facilities were	Quantitative	to assess the Zambian health system's capacity to address in NCDs, using an	Feasibility	There appeared to be wide heterogeneity between facilities in respect of readiness to manage NCDs. Only 6

		<p>assessed and 3 1st level hospitals/</p> <p>This was a cross-sectional facility survey</p>		<p>adapted WHO Essential</p> <p>Non-Communicable Disease Interventions (WHO PEN) tool.</p>		<p>(including the three 1st level hospitals) out of the 46 facilities were deemed ready to manage NCDs. Only the first level hospitals scored a mean index higher than the 70% cut off; About medications needed to manage NCDs, urban and rural health facilities were comparably equipped.</p>
5	<p>Ghanshyam Ahir (2019)</p> <p>Gujarat-India(17)</p>	<p>N= one PHC, One CHC and one urban primary health centre (UPHC)/</p> <p>This was a cross-sectional/</p> <p>Data collection of this Baseline study was done with pretested structured monitoring tool based on WHO PEN /</p>	Quantitative	<p>To find out facility-level gaps for prevention and control of Non-communicable diseases and To prepare monitoring tool for NCD prevention and control services</p>	Feasibility	<p>Gaps regarding were lack of trained health personnel, no system of collection of health statistics about non-communicable diseases, Diagnostic criteria, Treatment protocol & Referral criteria was not available. Only screening criteria of diabetes and hypertension were available.</p> <p>Gaps do exist in the human resource capacity and service delivery for NCD prevention and control at the primary care level in both urban and rural area and secondary care level at community health centre assessed in Bhavnagar district.</p>
6	<p>Binod Kumar Aryal et al.(2018)</p> <p>Nepal(18)</p>	<p>N=92 health facilities/</p> <p>A descriptive cross-sectional study/</p>	Quantitative	<p>to assess the existing structure, supply and service system, facilities, equipment, medicine, procedure and capacity of health institution to deliver quality services.</p>	Feasibility	<ol style="list-style-type: none"> 1. Study reveals the gaps in capacity of health institution and system in terms of training, supply, equipment, and diagnostics. However, training of health workers, supply of essential medicines and improving the service delivery would supplement the effective implementation of PEN in Nepal. 2. The existing status of the health facilities for the implementation of the PEN is satisfactory.
7	Bawazir et al	N=41 out of 75 PHC	Quantitative	to assess the	Feasibility	The findings of this

	(2019) Saudi Arabia(19)	facilities/ A cross-sectional study / A rapid standardized WHO assessment package tool (WHO-PEN) was used to assess the capacity of the PHC services in preventing and control of NCDs.		capacity and readiness of primary healthcare centres (PHC) for the implementation of basic strategies for the prevention and control of NCDs		study showed no critical gap in the capacity related to the main areas of the essential PHC services to integrate and manage NCDs
8	Kofi Mensah Nyarko et al. (2016) Ghana(6)	N=24 health facilities from the three regions / a cross-sectional health facility-based survey	Quantitative	1. to identify existing and potential gaps that may hamper the smooth deployment of the package (PEN). 2. to assessing human resource capacity, equipment, service utilization, medicines availability and health financing.	Feasibility	The preparedness of the health facilities for the implementation of WHO-PEN intervention is unsatisfactory. Apart from health financing, major gaps in the human resource capacity, availability of medications, diagnostics, equipment and medical information management system are likely to hamper the smooth implementation of the WHO-PEN intervention.
9	Rogers et al. (2018) Uganda(20)	N= 53 public sector health facilities/ We developed a survey guided by the literature and the standards of the WHO PEN	Quantitative	to: (1) assess their capacity to detect and manage NCDs; (2) describe provider knowledge and practices regarding the management of NCDs; and (3) identify areas in need of focused improvement.	Feasibility	We identified significant resource gaps at all sampled facilities. All facilities reported deficiencies in NCD screening and management services.
10	Collins et al. (2017) Jordan(21)	N= Quantitative: We included 2907, Qualitative: We interviewed 16 participants/ a mixed-methods design of quantitative and qualitative strands of equal priority	a mixed methods	to identify opportunities to improve total CVD risk-based guidance for humanitarian settings.	Appropriateness	This demonstrated that despite the implementation of total CVD risk-based guidance, few patients had a documented and correct CVD risk score, and half of high risk patients were not prescribed lipid-lowering treatment. Many of the risk scores document inpatient records were inaccurate; of patients with a documented low-risk score, one in five were truly high risk. The qualitative analysis found nine

						themes that together helped theorise the quantitative findings and identify opportunities to improve the use of total CVD risk-based approaches in humanitarian settings.
11	Dweakat et al. (2017) occupied Palestinian Territory(22)	N=2200 patients with NCDs were registered in 14 pilot clinics/ A clinical audit/ A clinical audit was implemented by the completion of a field-tested questionnaire for every patient's file of a total of 493 files, using computer-generated random sample from the total list of 2200 registered patients. Indicators of file completeness and staff adherence to protocols were used to assess the quality of services.	Quantitative	To assess the quality of services provided through the new approach.	Fidelity	The audit showed that staff did generally follow the PEN protocols and adequately completed patient records. However, problem areas were highlighted, notably risk miscalculations (119 of 369 files, 32%); urine testing not regularly done for patients with diabetes mellitus (213 of 227 files, 96%); medical plan for the next scheduled visit not mentioned (or written) in the file (251 of 470 files, 53%); cholesterol testing done too frequently (106 of 471 files, 23%); and, not referring patients to higher levels of care according to the protocol's criteria (14 of 471 cases, 3%). The audit showed that in more than 10% of cases, doctors did not take appropriate clinical actions in the face of clear indications of NCD—eg, failure to address high blood pressure and high blood glucose.
12	Khan M Amir et al. (2018) Pakistan(23)	N=14 primary healthcare facilities/ The pragmatic cluster randomised controlled trial (cRCT)/ Clinics were randomised on a 1:1 basis (sealed envelope lottery method) and 250 patients recruited in the ACM arm and 245 in the TTR-only arm (age 25 years and HbA1c >7%). The primary outcome was the mean change in HbA1c (%) from baseline to 9-month	Quantitative	To assess if an integrated care package can achieve better control of diabetes.	Appropriateness	The ACM intervention in public healthcare facilities did not show a statistically significant effect on HbA1c reduction compared to the control (TTR-only) arm. Future evaluation should assess changes after a longer follow-up period, and minimal care enhancement in the comparator (control) arm.

		follow-up. Patients and staff were not blinded.				
13	Latt et al. (2016) Myanmar(8)	Perspective	Qualitative	Analysis of the gaps and challenges in diabetes care in Myanmar is expected to assist in the formulation and development of a national policy on NCDs and its implementation.	Penetration	The World Health Organization Package of Essential Noncommunicable (PEN) disease interventions for primary health care in low-resource settings has been piloted in Yangon Region and countrywide expansion awaits ministerial approval. Recently, the Myanmar Diabetes Care Model was proposed by the Myanmar Diabetes Association, with the aims of both bridging the gap in diabetes care between rural and urban areas and strengthening care at the secondary and tertiary levels. However, implementation will require policy development for essential drugs and equipment, capacity-strengthening of health-care workers, and an appropriate referral and health information system.
14	Mendis and et al. (2012) eight LMIC(2 low-income countries: Benin, Eritrea; 4 low-middle-income countries: Sudan, Bhutan, Sri Lanka, Vietnam; 2 upper-middle-income countries: Suriname and Syria)(7)	N=90 PC facilities/ A cross-sectional survey/	Quantitative	to evaluate the capacity of primary care (PC) facilities to implement basic interventions for prevention and management of major non-communicable diseases (NCDs), including cardiovascular diseases and diabetes.	Feasibility	Major deficits were identified in health financing, access to basic technologies and medicines, medical information systems, and the health workforce. The study has provided the foundation for strengthening the PC to address noncommunicable diseases. There are important implications of the findings of this study for all low- and middle-income countries as capacity of PC is fundamental for equitable prevention and control of NCDs.
15	Anna Kontsevaya and Jill Farrington (2017) Kyrgyzstan(24)	N=481 213 population / the retrospective evaluation of the implementation of the PEN protocols/ The evaluation included performance/quality	Quantitative	The study aimed to: • compare the inputs, outputs and outcomes for PEN pilot sites versus non-PEN pilot sites in Bishkek city for 12 months;	Appropriateness	• In general, additional costs per year per FMC, including the costs of preparation and implementation, were low (US\$ 866). Only three FMC needed to buy the

indicators and effectiveness indicators.

- assess the possibility of and perspectives for developing an approach to the economic evaluation of PEN implementation in Kyrgyzstan that can be of value for other countries;
- inform the future development of PEN implementation in Kyrgyzstan.

additional **equipment**; the other seven had it already.

- For all indicators, the CI were overlapping, indicating no statistically significant difference over time. In PEN centres in 12 months after the implementation of the PEN protocols, the number of visits by patients with blood pressure both above and below the recommended thresholds per 100 000 population appeared to double compared with the period before implementation of PEN. Even if this were statistically significant, it would be difficult to interpret as it could reflect changes in detection through screening (probable) rather than changes in blood pressure control (possible).
- The evaluation of the short-term effects 12 months' in terms of changes in prespecified performance and effectiveness indicators in PEN centres **did not show clear and significant** evidence of a real impact resulting from the implementation of the PEN protocols on primary care, so there were no

						<p>arguments for performing a long-term economic analysis of the combination of the effects and costs.</p> <p>There was some non-significant positive effect on the effectiveness indicators reflecting blood pressure control (number of ambulance calls for hypertension, number of hospital admissions for hypertension, visits to clinics by patients with extremely high blood pressure) in the PEN centres but not in the non-PEN centres. It could be that this format of PEN implementation did not affect the detection rate but did affect the medical care of hypertension patients who were already under supervision in the FMC. The large variability in the numbers in the indicators quoted above militates against finding a significant difference between PEN and non-PEN FMCs and makes the point about the definite improvement in blood pressure control in PEN centres compared with non-PEN centres.</p>
16	Nadim Barghouthi et al. (2017) Palestinian territory(25)	<p>N=14 primary care clinics</p> <p>PRM includes a qualitative component that allows for in-depth discussions with patients and a quantitative component that ranks issues identified by participants as important.</p>	a mixed method	to ascertain patients perceptions of changes in NCD services	Appropriateness	All four groups identified positive changes in NCD service delivery since the PEN was introduced. More thorough physical examination by a doctor, more time with the doctor, perceived improvement in prescription of drugs, and better organisation of laboratory tests were all ranked in the top three positive changes by two out of four groups. Regular measurements of blood pressure, waist circumference, and weight taken by nurses, and health education messages

						provided by nurses to patients as part of the protocol, in addition to shorter waiting times were in the top eight improvements noted by all four groups. Additionally, application of an appointment system was identified as a positive change by three groups. Both male groups appreciated an increased follow-up period between visits, whereas neither group of women mentioned this as a substantial factor. No negative perceptions related to the PEN were expressed.
17	Zhang et al. (2016) China(4)	A Policy Statement	Qualitative	Policy Statement on the Implementation of the World Health Organization's Non-Communicable Diseases Intervention Package for Primary Health Care in low Resources setting	Appropriateness	The World Hypertension League recommends the implementation of WHO PEN in low-resource settings as a cost-effective and equitable means to control hypertension in the context of other NCDs and health risks. People with NCDs require long-term care that is proactive, patient-centred, community-based, and sustainable. Such care can be delivered equitably only through health systems based on primary healthcare. The implementation of the WHO PEN interventions will not only help to reduce the burden of NCDs and hypertension, but strengthen the efficiency and equity of the health system.
18	Sanjay Basu et al. (2018) South Africa(26)	N=17 743 respondents aged 15 years or older/ Cost-effectiveness analysis	Quantitative	To assessed how cardiovascular risk factors are distributed across subpopulations within South Africa and identified which cardiovascular treatments should be prioritised.	Cost	The incremental cost-effectiveness of implementing SA PC 101 over current treatment would be a saving of US\$24 902 (95% CI 14 666–62 579) per DALY averted compared with a saving of \$17 587 (1840–42 589) under WHO PEN guidelines. · With the implementation of the WHO PEN guidelines, we would

anticipate a considerably higher proportion of the population treated with statins, followed by increased treatment for hypertension and then glycaemic control for diabetes. But we additionally found that implementation of the SA PC 101 guidelines averted slightly more overall DALYs and had better cost-effectiveness than implemented the WHO PEN guidelines. The key benefits of the SA PC 101 guidelines in terms of DALYs was a result of more assertive blood pressure treatment, particularly for high-risk patients, whereas the benefits, in terms of costs, were primarily from less assertive blood glucose control than under the WHO PEN guidelines. We found that if either guidelines were implemented with coverage rates similar to a well-performing European health system, the Sustainable Development Goals target 3.4 (reduction in premature mortality from non-communicable diseases of one third) would be readily achieved.

19	Dylan Collins et al. (2017) Kyrgyzstan(27)	N=30 participants(15 doctors and 15 nurses)/ the retrospective evaluation and interview(pilot study)	a mixed methods	to identify opportunities to improve the implementation of PEN in Kyrgyzstan.	Appropriateness	<p>. Qualitative analysis found 11 themes which seemed to help explain the quantitative findings.</p> <p>Eleven themes were identified which are categorized as provider-centred and patient-centred.</p> <p>Implementation of a total cardiovascular risk approach, in this case through the PEN protocols and risk prediction charts, would benefit from multifaceted and repeated training, maintenance of the quality of intervention, systematic approaches to identifying the target population and achieving coverage, and a simpler workflow. Overall the concept is well-received by providers but its implementation needs fine-tuning and to draw more upon evidence-based approaches to the implementation of clinical guidelines and changing clinical practice. Similarly, the engagement of patients and increasing coverage of the target population is likely to need a combination of supportive push and pull factors.</p>
20	Wangchuk Dukpa et al. (2015) Bhutan(28)	A model-based economic evaluation	Quantitative	To assessing the cost-effectiveness of the PEN project implemented in Bhutan and analysing the costs and health consequences of the program in both the short and long term.	Cost	<ol style="list-style-type: none"> 1. Results confirm that the current PEN program and universal screening are certainly cost-effective and, most likely, cost-saving options in Bhutan. 2. The cost-effectiveness acceptability curves for all options and demonstrates that both the current PEN program and universal screening are

superior to no screening, at any willingness-to-pay threshold.

3. The current PEN program is shown to be a cost-saving intervention, as long as the prevalence of diabetes and hypertension is higher than 0.3 per 1000 people in the population. This is significantly lower than the current prevalence of diabetes and hypertension in Bhutan, which is 342 per 1000 people in the population.
4. The results support the WHO's standpoint, which indicates that the WHO PEN is very cost-effective and feasible to implement in all countries.
5. As a result, we believe that the results of the analysis are likely to be conservative and the scaling-up of diabetic and hypertension screenings to a national-wide program should be a priority in Bhutan.
6. This study further recommends universal screening instead of opportunistic screening at primary care facilities because of the relatively high prevalence of diabetes in the

						<p>Bhutanese population.</p> <p>From the sensitivity analysis, the value of the screening options remains the same when disease prevalence varies. Therefore, applying this model to other healthcare settings is warranted, since disease prevalence is one of the major factors in affecting the cost-effectiveness results of screening programs.</p>
21	<p>Rattanaipapong et al. (2016)</p> <p>Indonesia(29)</p>	<p>Model-Based Economic Evaluation</p>	Quantitative	<p>To evaluate the cost-effectiveness of the PEN program compared to a “no screening” policy choice.</p>	Cost	<p>Cost-Effectiveness Results-Providing the current PEN policy had the greatest health benefits in terms of the lowest DALYs lost or highest DALYs averted compared to no screening</p> <p>Budget Impact Analysis-The results indicate that annual total budget impact for the current PEN program is approximately 565 trillion IDR for the first year and 2,750 trillion IDR over five years.</p>
22	<p>Choe et al. (2017)</p> <p>Democratic People's Republic of Korea(30)</p>	<p>N=32 000 population/</p> <p>the feasibility study/</p> <p>The performance of the pilot project was evaluated in December 2015. Based on the WHO health-system evaluation framework, a pilot project-evaluation framework was prepared in consultation with the program managers.</p>	Quantitative	<p>to assess the feasibility of integrating the interventions into the existing primary healthcare system.</p>	Feasibility	<p>The household doctors were able to detect and manage risks for cardiovascular disease and diabetes by using the protocols based on WHO PEN. Among 18 340 individuals aged over 35 years, implementation of WHO PEN interventions led to a significant reduction in the number of people with a 10-year risk of cardiovascular disease $\geq 20\%$ (from 1748 [9.5%] to 543 [3.0%]) over 1 year. Involvement of household doctors can increase access to services for prevention and control of cardiovascular disease and diabetes in the Democratic People's Republic of Korea.</p>
23	<p>Wangchuk et al. (2014)</p> <p>Bhutan(31)</p>	<p>a performance assessment study(Descriptive analysis & before-after analysis)</p>	Quantitative	<p>The performance of the PEN project in detecting and managing non-communicable</p>	Appropriateness	<p>In 3 months, 39 079 patients had attended clinics in the pilot districts. About 10% of the clinic attendees</p>

				diseases (NCDs) and their risk factors was assessed.		(3818/39 079) were aged over 40 years; of these, 22.6% (864/3818) had a high blood pressure, and 49.7% (1896/3818) were overweight/obese or had a high waist circumference. Screening of overweight/obese/high waist circumference cases revealed that 26.1% (494/1896) had high blood sugar levels. Out of the 896 patients who were registered on PEN protocols, 13% had >20% risk of developing cardiovascular diseases (CVDs) in next 10 years as per the WHO/International Society of Hypertension risk-assessment charts. Among 444 who had three follow-up visits, high 10-year-CVD risk (>20%) had declined from 13% to 7.3%. Among 400 persons with hypertension, use of medication increased and high blood pressure declined from 42.3% to 21.5%. Among 115 persons with diabetes, use of anti-diabetes medication increased and high blood sugar declined from 68/100 to 51/100.
24	Jarvis JD et al. (2019)(32)	Three lists of WHO(Best Buys-PEN- HEARTS) endorsed priority NCD interventions were included. A database with 137 national Essential Medicines List (EMLs) and the WHO EML was created from the WHO Repository and these EMLs were compared for a listing of priority NCD interventions.	Quantitative	To determine across a wide range of countries which national EMLs have listed the priority NCD interventions recommended by WHO NCD packages and guidelines.	Penetration	Across 137 countries with national EMLs, the median percentage of 20 Best Buys interventions listed was 90% (IQR 80–95) and 31 Package of essential noncommunicable disease interventions (PEN) interventions listed was 94% (IQR 90–97), of 9 HEARTS interventions was 100% (IQR 89–100), and of the 43 unique interventions across the three priority lists was 88% (IQR 84–93). The median percentage of countries that included each of the 31 interventions recommended in the PEN priority list was

						94% (129 of 137) (IQR: 89–98%), that is, PEN priority medicines were included in most national EMLs. The priority intervention included in the fewest national EMLs was senna (47 of 137 countries, 34%). The median percentage of PEN medicines included by each country was 94% (29 of 31) (IQR: 90–97%), that is, national EMLs included most priority medicines. Thirteen countries had a coverage rate of 100%, meaning they included all 31 medicines or medicine classes on their EML.
25	Upreti et al. (2016) Nepal(5)	Perspective	Qualitative	Addressing the growing burden of diabetes in Nepal	Appropriateness	<p>The lack of awareness, inadequate services for diabetes management, including early detection, the cost of services, and the country's topography are barriers to diabetes care.</p> <p>The government of Nepal therefore has an opportunity to strengthen health-care services via primary health-care facilities, by implementing the essential package of NCD interventions. Phased implementation and escalation of coverage of PEN in all 75 districts³⁰ brings opportunities to strengthen the health workforce, diagnostics, medicines and supplies, the health information system, research and surveillance and reduce inequity in diabetes care in Nepal. To strengthen the roll-out of PEN in Nepal, we recommend revision of the free essential medicines list of the Ministry of Health and Population, to cover essential drugs for management of NCDs.</p>
26	Martinez et al. (2015)	This brief report describes the	Quantitative	These assessed the use of the PEN	Appropriateness	After six months, two of the four PEN

Philippines(33)	implementation of two of the four PEN protocols in Region 8 – Protocol 1 on managing and preventing heart attack, stroke and renal disease and Protocol 2 on health education and promotion and smoking cessation.		protocols, availability of PEN implementation tools and whether the implementation targets for Region 8 had been met.	indicators had been met in Region 8: all primary health care facilities had trained health service providers and complete sets of essential equipment. The other two indicators had not been met as only 19% of monitored primary health care facilities had complete sets of essential medicines provided by the DOH and only 44% were implementing PEN where the target for each was 80%.
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Figures

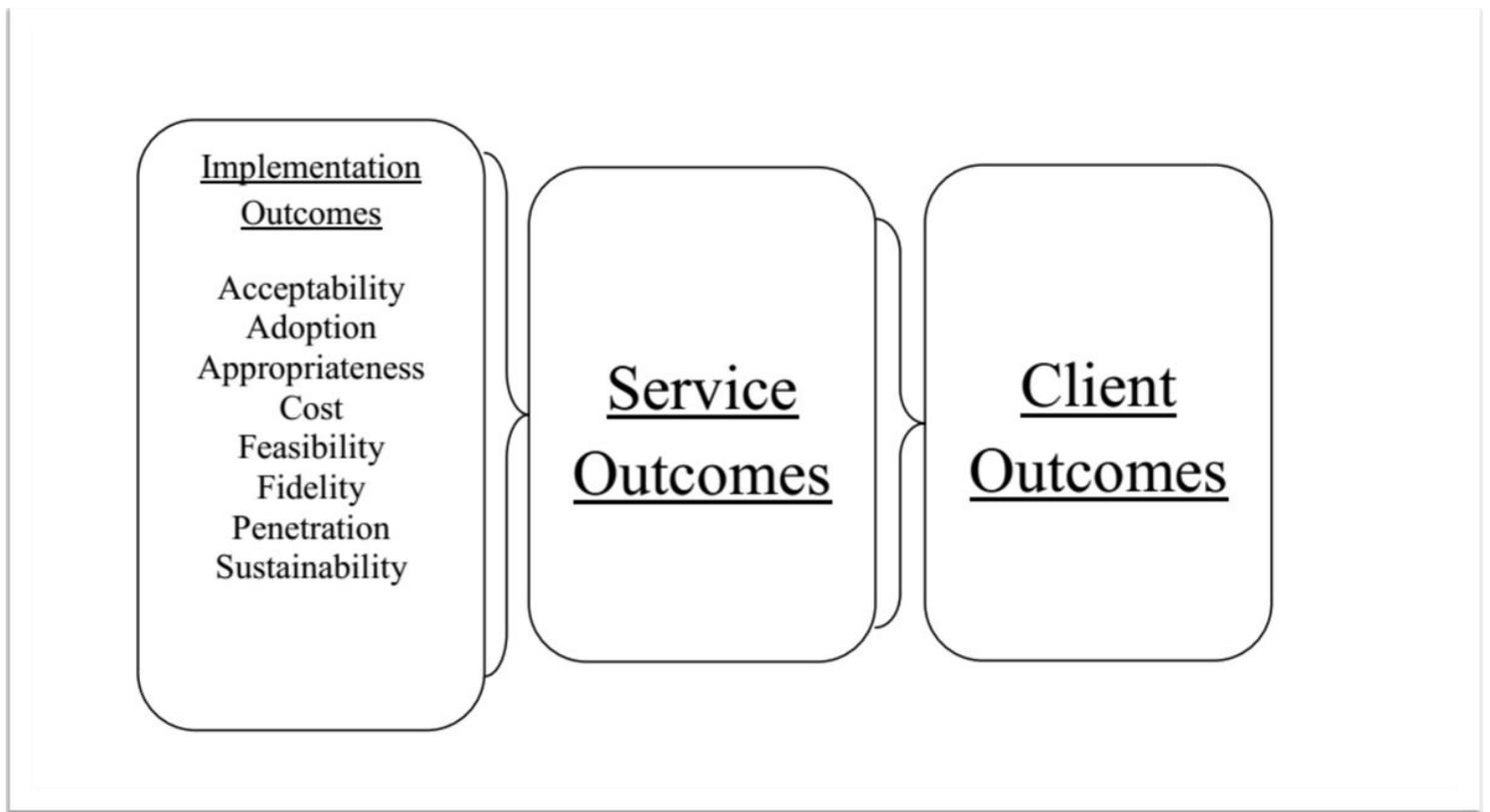


Fig.1 Implementation research conceptual model

Figure 1

Implementation research conceptual model

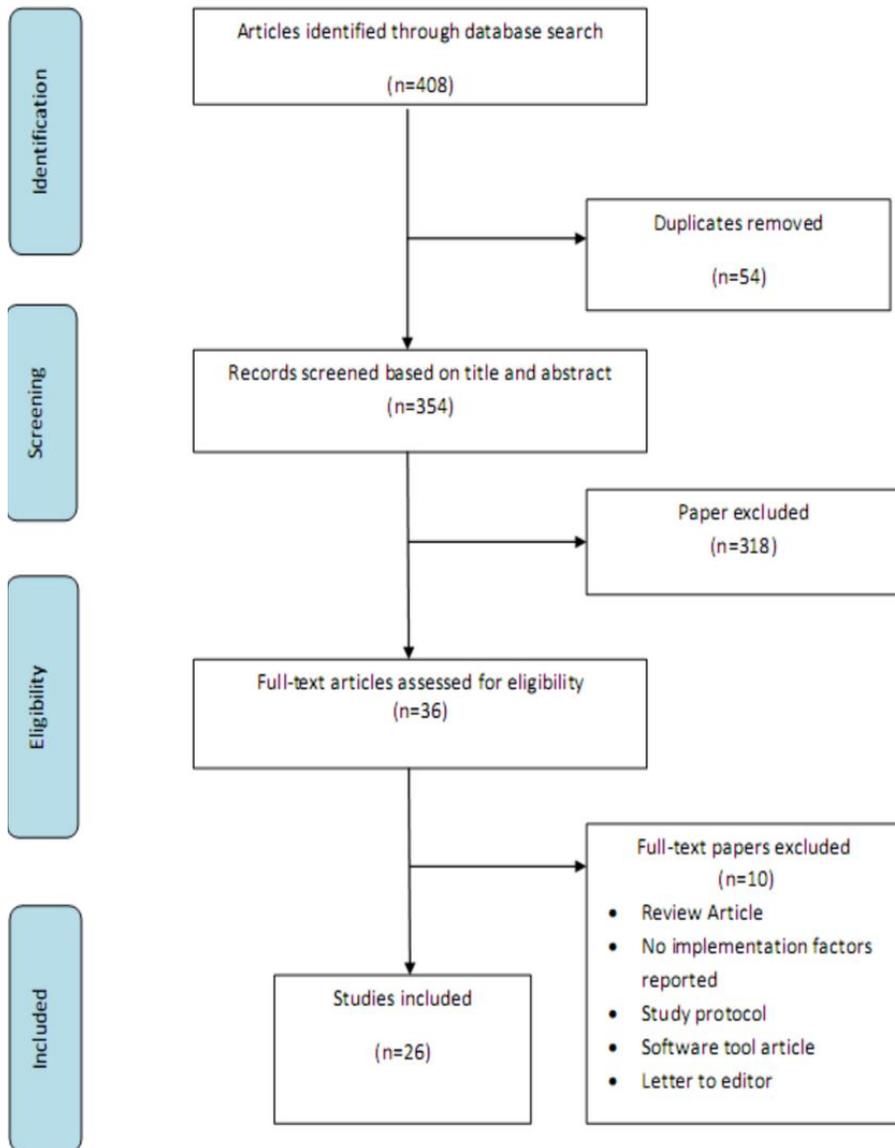


Fig 2. Process of selecting studies for scoping review

Figure 2

Process of selecting studies for scoping review

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