The Prevalence of Non-Communicable Diseases Among Syrian Refugees in Syria's Neighbouring Host Countries: A Systematic Review and Meta-analysis

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Abstract

Background: Alarming rates of non-communicable diseases (NCDs) have been observed in low- and middle-income countries (LMICs) where most refugees reside. There is concern Syrian refugees may experience significant NCD-related health needs, which have significant health implications - including in the context of the COVID-19 pandemic, and which must be addressed by health systems in neighbouring host countries. Whilst primary studies on this topic exist, there has been no comprehensive synthesis of the existing evidence base. The aim of this systematic review and meta-analysis was to synthesise evidence on the prevalence of NCDs among Syrian refugees residing in neighbouring host countries.

Study design: Systematic review and meta-analysis.

Methods: The review was carried out in line with PRISMA guidelines (PROSPERO CRD420201970430). MEDLINE, CINAHL, EMBASE and PubMed databases were searched from 1 January 2011 to 01 November 2021. Peer-reviewed studies reporting prevalence data on the five most common NCDs among adult Syrian refugees living in Turkey, Lebanon or Jordan were included. Methodological quality was assessed using the Joanna Briggs Institute critical appraisal checklist for prevalence studies. Meta-analysis was carried out to estimate the pooled prevalence of these NCDs in community and primary care settings.

Results: 466 citations were identified, 18 of which were included, representing 237,723 Syrian refugees. In community settings, the prevalence of hypertension, diabetes mellitus type II, cardiovascular diseases, chronic respiratory diseases and arthritis was 24% (95% CI: 17–32), 12% (8–15), 5% (3–7), 4% (3–5) and 11% (7–14), respectively. The prevalence of hypertension 35% (33–36) and diabetes mellitus type II 48% (24–72) were significantly higher in primary care settings.

Conclusion: The findings demonstrate a high prevalence of NCDs among Syrian refugees. Evidence-based preventive and management interventions for NCDs are needed in this context, both to address acute health needs during the COVID-19 pandemic, and the longer-term health burden of NCDs.

Keywords: Systematic review; Non-communicable diseases; Chronic diseases; Syrian refugees

Introduction

Non-communicable diseases (NCDs) among socially marginalised groups are considered an important public health challenge, particularly in conflict-affected populations.[1] Forced migrants are more vulnerable to NCDs due to migration-specific factors such as unhealthy living conditions, psychosocial stress and limited access to timely treatment.[2,3] However, NCDs have been under-prioritised compared to communicable diseases. This is mainly because the health systems of refugee-receiving countries prioritise the urgent need to contain the spread of infectious diseases.[4,5] The COVID-19 pandemic has added one more hardship to the care of NCDs by increasing the burden on overstretched health systems, particularly in low- and middle-income countries (LMICs), where the majority of refugees reside.[6]

Syria, an LMIC in the Eastern Mediterranean region with a population of approximately 18,430,000, has been experiencing war and conflict since 2011, and is considered the greatest emergency for displacement and the largest humanitarian refugee crisis at the current time.[7,8] As of April 2021, more than 5.6 million people were registered as Syrian refugees.[9] Among these, around 65%, 15% and 12% were hosted by Syria's neighbouring countries, Turkey, Lebanon and Jordan, respectively, while 7.3% were hosted by other countries.[9]

A recent systematic review on Syrian refugees reported NCDs as one of the five most prevalent health needs.[10] The prolonged nature of displacement and influx of refugees in need of continuous and long-term NCD care has amplified the burden of NCDs in countries receiving large numbers of refugees.[4,11,12] This has created significant pressure on health systems in these three countries, as well as international organisations, exceeding their ability to provide adequate health care services.[13–16]

Whilst there has been primary research on NCDs on forced migrants, there has been no previous comprehensive and systematic synthesis of data on the prevalence of NCDs among Syrian refugees to inform health care policy, interventions, allocation of resources, and future research priorities. Thus, the aim of this systematic review and meta-analysis was to synthesise existing evidence on the prevalence of NCDs among Syrian refugees residing in Syria's neighbouring host countries.

Methods

This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement[17] (Appendix I) and was registered with PROSPERO (CRD42020197043).

Inclusion criteria

The review included all published peer-reviewed papers reporting primary data in which the outcome was at least one of the five most common NCDs among adult (i.e., over 16 years old) Syrian refugees residing in Turkey, Lebanon or Jordan. Whilst NCDs affect people of all age groups, evidence shows that NCDs are often associated with older age groups, justifying our choice of adults.[18] The NCDs were

hypertension, diabetes mellitus type II (DM II), cardiovascular diseases (CVDs), chronic respiratory diseases (CRDs) including chronic obstructive pulmonary disease (COPD) and asthma, or arthritis. According to World Health Organization(WHO) and The United Nations High Commissioner for Refugees (UNHCR) data, these are the most common NCDs in the target population.[19,20] Papers not reporting data specifically on adult refugees, or in which data on this population could not be disaggregated were excluded. Where multiple papers were identified reporting on the same population, the most comprehensive one was included to avoid duplicating participants.

Search strategy

The Syrian conflict began in 2011.[21] As such, we searched the following databases from 1 January 2011 until 01 November 2021: MEDLINE, CINAHL, EMBASE and PubMed, with no language restrictions. We also searched reference lists of all the included studies. Appendix II details the database-specific search strategies.

Studies that reported on the prevalence of NCDs in our target population were included regardless of the type of reporting and the primary outcomes used align with measurements in or previous research and guidelines,[22] which included, self-reporting by patients, specific diagnostic criteria for HTN (i.e., systolic blood pressure ≥ 140 and/or diastolic blood pressure ≥ 90 mmHg or currently on medication for raised blood pressure), and biologically based prevalence (i.e., measuring blood pressure and glucose levels.

Screening, data extraction and quality assessment

Two authors (AA and OH) independently screened titles, abstracts and full texts of all identified records for eligibility using Rayyan. Authors of studies were contacted to clarify missing or unclear data. Data were extracted independently by two authors (AA and OH) including citation details, study characteristics, participant characteristics relevant to the selection criteria, and prevalence data. Included studies were independently assessed by these two authors for methodological quality using the Joanna Briggs Institute (JBI) critical appraisal checklist for prevalence studies.[23] The JBI checklist assesses the methodological quality of a study and determines the extent to which a study has addressed the possibility of bias in its design, conduct and analysis.[23] Disagreements were resolved by discussion between the four authors (AA, OH, KC and LN). Additional details on the methods used in this systematic review are provided in Appendix III.

Data synthesis

Studies that met the inclusion criteria were categorised into one of the three following settings: studies conducted in community settings, primary care settings and emergency departments or tertiary hospitals. Meta-analyses were performed where there were at least two studies reporting the prevalence of NCDs in community or primary care settings. Data were analysed using STATA 16. The metaprop command was utilised to calculate pooled estimates for prevalence and 95% CIs.[24] Random-effects models were used because the effect estimates were expected to be heterogeneous due to varied sample sizes, settings/contexts, study country, and

data collection years in the studies.[25] Where a study reported the prevalence as a percentage (% prevalence), the number of cases (n) was calculated for the meta-analysis.

Heterogeneity was assessed statistically using the I^2 statistic. Papers not reporting prevalence data or in which data could not be disaggregated for NCDs were not included in the meta-analyses. Where meta-analysis was deemed inappropriate, narrative synthesis was conducted.

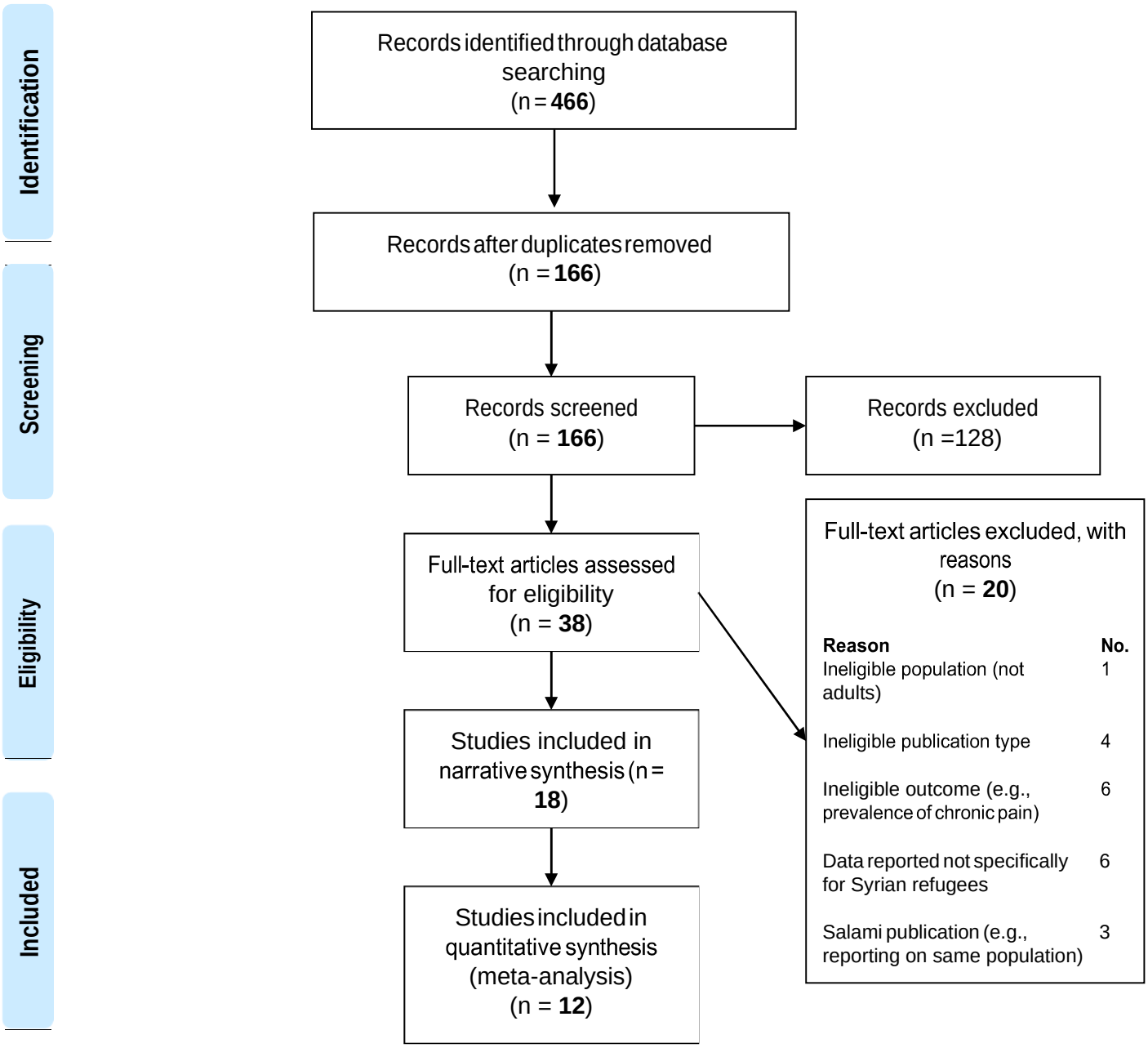
Results

Study selection

A total of 466citations were identified from the database searches, of which, 128were excluded after screening titles and abstracts (Figure 1). A further 20 articles were excluded after full text screening. The reasons for exclusion of these 20 articles are presented in Figure 1. The remaining 18 articles met our inclusion criteria and were included in the review.[26,27,36–43,28–35]

All 18 articles were included in the narrative synthesis, 12 of which were included in the meta-analysis.[26,27,41,42,28–31,34,35,37,38] Of the articles excluded from the meta-analysis, two reported aggregated data on multiple NCDs that made it difficult to identify the number of cases for a specific NCD, precluding it from being included in the meta-analysis for this disease.[32,43] Four articles only reported data from tertiary hospital settings or participants who were referred to an emergency department, and thus were unlikely to reflect the general population prevalence.[36,39,40,44]

Figure 1. PRISMA Flow Diagram



Study characteristics

Eleven of the 18 articles utilised a cross-sectional study design,[28,29,44,30–32,36–38,40,41] while two were cohort articles,[35,39] and five articles used a mixed-methods design (Table 1). The quantitative component of the mixed-methods study design included an analysis of NCD databases,[26] one cohort study,[27] and three cross-sectional surveys.[34,42,43]

A total of 237,723 Syrian refugees, including 210,685 from Turkey, 8,745 from Lebanon, and 18,293 from Jordan of overlapping populations in the community, were included in the systematic review. Sample sizes ranged from 67 to 191,034 Syrian refugees.[36,45] The mean age of the participants was reported in six articles.[27,34,37,39,43,46] It ranged from 18 to ≥ 60years.

Four of the included articles were conducted in Turkey,[31,36,39,47] eight were conducted in Lebanon [27,28,34,41–43,48,49]and six were carried out in Jordan.[29,32,33,37,38,50] Four articles recruited participants from primary care clinics.[30,32,48,50] Four articles recruited participants from tertiary hospital settings,[33,36,39,47] including two articles that recruited participants from the emergency department.[36,47] Participants were recruited from various community settings in eight articles.[28,29,34,37–39,41,42] Of those, two articles recruited participants from migration centres,[41,42] five articles recruited participants from house-hold settings [28,29,37,38,42]including participants living inside and outside of camps,[40] participants residing in urban camps,[34] and participants residing outside the camps only.[28,29,38] One study recruited participants from both households and clinics, but using separate surveys.[43]

12 of the included articles reported on the prevalence of DM II.[28–30,33,41,42,45,48,50] 11 articles reported on the prevalence of hypertension.[27,28,48,29,31,33,34,37–39,42] Nine articles reported the proportion of participants who have CVDs.[29,33,34,38,39,41,42,45,50] Three articles reported on the prevalence of both asthma and COPD,[36,40,41] one article reported on the prevalence of COPD only,[39] and five articles reported on the prevalence of CRDs.[28,29,34,40,42] Three articles reported on the prevalence of arthritis.[28,29,34]

Author and year of publication	Study design	Country	Setting	Data collection years	Syrian Sample size N	Female n (%)	Population	Primary outcomes of interest	Critical Appraisal Score (%)
Collins, D, et al. (2017)	Mixed-methods	Jordan	Primary care clinic	2014-2015	2,907	1,773 (61)	Non-camp based adult Syrian refugees vising outpatient NCD clinics in Irbid Governorate.	DM II, CVDs	89
Doocy, S, et al. (2018)	Mixed-methods	Lebanon	Primary care clinics	2015-2016	637	427 (67)	Syrian refugee patients who have hypertension or DM II or both, visiting primary health care facilities in Lebanon that serve both Syrian refugees and Lebanese citizens.	HTN, DM II	67
Doocy, S, et al. (2016)	Cross-sectional	Lebanon	Households	2014	3,886	NA	A nationally representative sample of Syrian refugees residing in non-camp areas.	HTN, DM II, CVDs, arthritis, CRDs	67
Doocy, S, et al. (2015)	Cross-sectional	Jordan	Households	2014	4,433	NA	A nationally representative sample of Syrian refugees living outside of camps.	HTN, DM II, CVDs, arthritis, CRDs	78
Elliott, J, et al. (2018)	Cross-sectional	Lebanon	Primary care clinics	2015	292	180 (62)	All adult Syrian refugees seeking care for diabetes in MSF clinics in Bekaa Valley, Lebanon.	DM II	78
Evurt, M, and Mevlüde G. (2020)	Cross-sectional	Turkey	Households	2015	5,322	NA	18-69 years old Syrian refugees, living inside camps and outside camps.	HTN	89
Gammouh, O, et al. (2015)	Cross-sectional	Jordan	Primary care clinics	2013-2014	765	425 (55.6)	Syrian refugee adults (≥18) visiting Cartias centres in six cities in Jordan.	NCDs	67
Hani, A, et al. (2019)	Cross-sectional	Jordan	Tertiary hospital	2016	969	283 (27.8)	Syrian refugee adults (≥18) visiting the Cardiology and Cardiovascular Departments at Jordan University Hospital.	HTN, DM II, CVDs	22
Kiraki, F M, et al. (2021)	Mixed-methods	Lebanon	Urban camps	2017	101	88 (88)	Syrian refugee adults (≥18) who left Syria during or after 2011 that are residing in the BBRC.	HTN, DM II, CVDs, arthritis, CRDs	56
Kayali, M, et al. (2019)	Retrospective cohort	Lebanon	Primary care clinics	2016-2017	2,566	NA	Syrian patients with DM (types I and II) or hypertension, who were enrolled in the MSF NCD program.	HTN, DM II	67
Kurtulus, Ş, et al. (2018)	Cross-sectional	Turkey	Tertiary hospital (Emergency department)	2015	191,034	NA	Syrian refugees living in a tent camp in the district Şanlıurfa Ceylanpınar who were admitted to Şanlıurfa Ceylanpınar State Hospital center, Annex Building Chest Diseases Policlinic and Emergency Polyclinic with chest complaints.	Asthma, COPD	33
Ratnayake, R, et al. (2020)	Cross-sectional	Jordan	Households	2019	1190	782 (65.7)	Syrian refugee nonpregnant adults (≥18) originating from southern Syria who are living in the districts of Ramtha and Mafraq, Jordan.	HTN, DM II	89
Rohr, M, et al. (2018)	Cross-sectional	Jordan	Households	2016	8,029	NA	Syrian refugee adults (≥18), living outside official refugee camps in Irbid governorate, if they arrived in Jordan in or after January 2012 and if they were living in Jordan in the six months prior to the survey interview.	HTN, CVDs	78
Sahin, et al. (2018)	Retrospective cohort	Turkey	Tertiary Hospital	2015-2017	67	13 (19.4)	Syrian refugees undergoing coronary artery bypass surgery in Haseki Training and Research Hospital in Istanbul.	HTN, DM II, COPD, CVDs	56

Sengoren Dikis, O, et al. (2020)	Cross-sectional	Turkey	Tertiary hospital (Emergency department)	2017-2018	14,262	8,111 (56.9)	Patients who presented to the Bursa Yuksek Ihtisas Training and Research Hospital Adult Emergency Department during the study data collection period.	Asthma, COPD, CRDs	89
Stømme, E, et al. (2020)*	Cross-sectional	Lebanon	Community centre	2017-2018	506	255 (51)	Adult Syrian refugees attending educational activities at the IOM, who are under protection by the UNHCR in Lebanon, awaiting resettlement in Norway.	DM II, asthma, COPD, CVDs	44
Strong, J, et al. (2015)	Mixed-methods	Lebanon	Community centre	2013	167	NA	Refugees from Syria aged 60 and above registered with CLMC or PALWHO as of January 2013.	HTN, DM II, CVDs, CRDs	78
Truppa, C, et al. (2019)	Mixed-methods	Lebanon	Households and clinics	2017	590	447 (93.7)	Women of reproductive age between 18 and 50years and caretakers of children less than 18years in the catchment areas of three ICRC-supported facilities.	NCDs	78

***NA**: Not Available*
***BBRC**: Bourj al-Barajneh Refugee Camp*
***MSF**: Médecins Sans Frontières*
***PAD:** Peripheral artery disease*
***CLMC**: Caritas Lebanon Migrant Centre*
***PALWHO**: Palestinian Women's Humanitarian Organisation*
***IOM**: International Organization for Migration*
***ICRC**: International Committee of the Red Cross*
******: this study was conducted in Lebanon and Norway. However, data presented in this table are only for Lebanon.*

The methodological quality of studies

A summary of the critical appraisal of included studies is shown in Appendix V. Overall, the quality of included studies was high. The median score for the number of 'Yes' in each included study was nearly 73%. Nine articles scored above the median score with scores ranging from 78-89% [29–31,37,38,40,42,43,50](Table 1). Three articles met eight of the nine critical appraisal questions and achieved a score of 89%.[31,37,40]The reporting of some of the included studies was poor based on the "unclear" answers (as shown in Appendix VI).

Prevalence of NCDs

Studies that were excluded from the meta-analysis are shown in Appendix IV. A summary of the pooled prevalence estimates of the meta-analyses (i.e., the forest plots) for the five most common NCDs among Syrian refugees in Syria's neighbouring host countries in both community and primary care settings is presented in Table 2.

Table 2. Pooled prevalence estimates for the five most common NCDs among Syrian refugees in Syria's neighbouring host countries

Type of NCD	Number of included studies	Pooled prevalence estimate (%)	95% CIs
Community settings			
Hypertension	**7**	**24**	**17 – 32**
DM II	**6**	**12**	**8 – 15**
CVDs	**6**	**5**	**3 – 7**
CRDs	**5**	**4**	**3 – 5**
Arthritis	**3**	**11**	**7 – 14**
Primary care settings			
Hypertension	**2**	**35**	**33 – 36**
DM II	**4**	**48**	**24 – 72**

Prevalence of hypertension

Seven studies were included in the meta-analysis on the prevalence of hypertension in community settings. The pooled prevalence was 24% (95% CI: 17 – 32; I^2=99.7%). In primary care settings specifically, the pooled prevalence was 35% (95% CI: 33 – 36). Figure 2 presents forest plots showing these results. In addition, there are two studies conducted in tertiary hospitals, one in Jordan,[44] and the other in Turkey,[39] which showed elevated prevalence of hypertension of 36% and 60%, respectively (Appendix IV).

Prevalence of DM II

The pooled prevalence of DM II in six studies conducted in community settings in Lebanon and Jordan was 12% (95% CI: 8 – 15; I^2=97.5%) (Figure 3). The pooled proportion is elevated to 48% (95% CI: 24 – 72; I^2=99.8%) in primary care settings (Figure 3), and ranged from 32% to 33% in tertiary hospital settings Jordan [44] and Turkey,[39] respectively (Appendix IV).

Prevalence of CVDs

Figure 4 presents a forest plot for the pooled proportion of Syrian refugees with CVDs in community settings in both Lebanon and Jordan. The overall estimated pooled prevalence of CVDs among the six studies reporting on CVDs in community settings in the two countries was 5% (95% CI: 3 – 7; I^2= 96.1%). In tertiary hospitals, the prevalence of CVDs ranged from 57% in Turkey [39] to 72% in Jordan [44](Appendix IV).

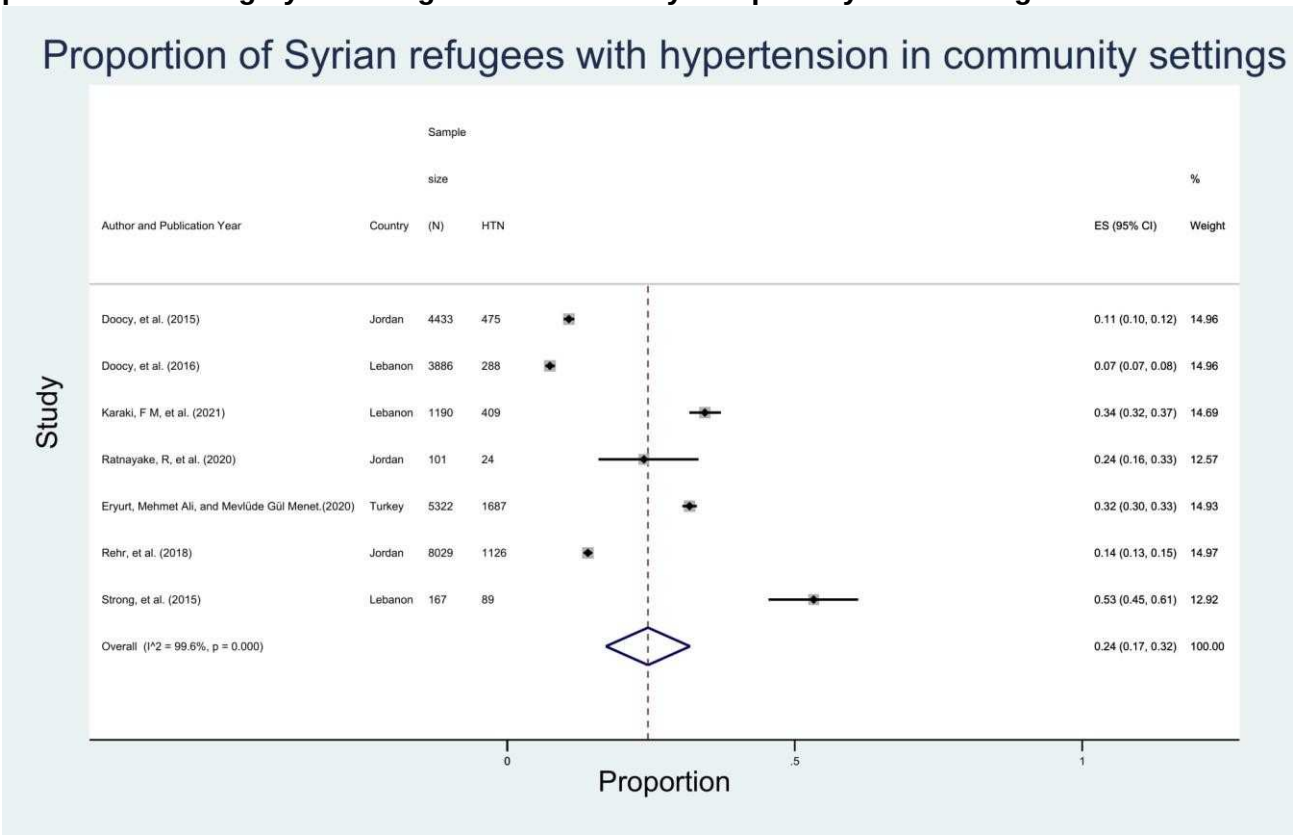
Prevalence of CRDs

The reported prevalence of CRDs in community settings from the five studies included from Lebanon and Jordan was 4% (95% CI: 3 – 5; I^2=87.07%) as shown in Figure 4.

Prevalence of arthritis

Figure 5 presents a forest plot showing the pooled prevalence of arthritis in Lebanon and Jordan. The pooled prevalence of arthritis in community settings in these three countries was 11% (95% CI: 7 – 14).

Figure 2. Forest plot showing point estimates with 95% confidence intervals for prevalence of hypertension among Syrian refugees in community and primary care settings.



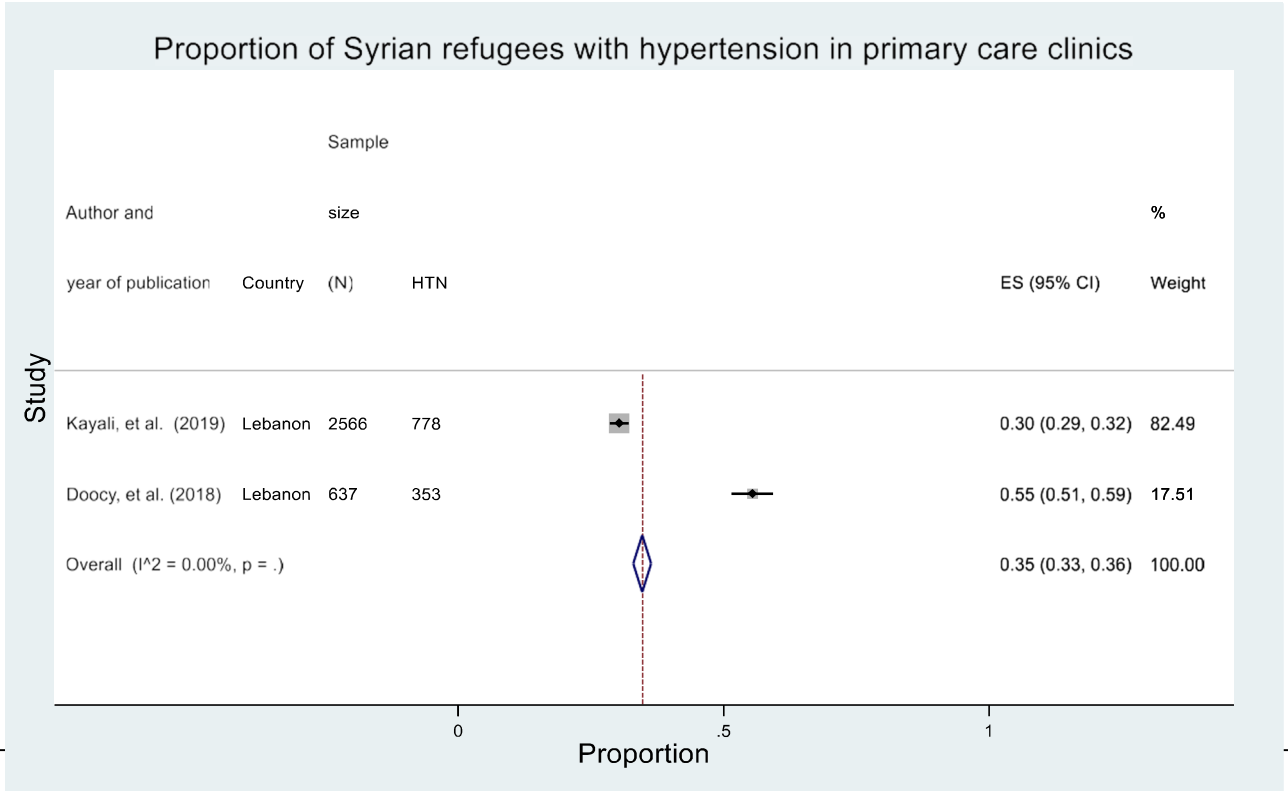
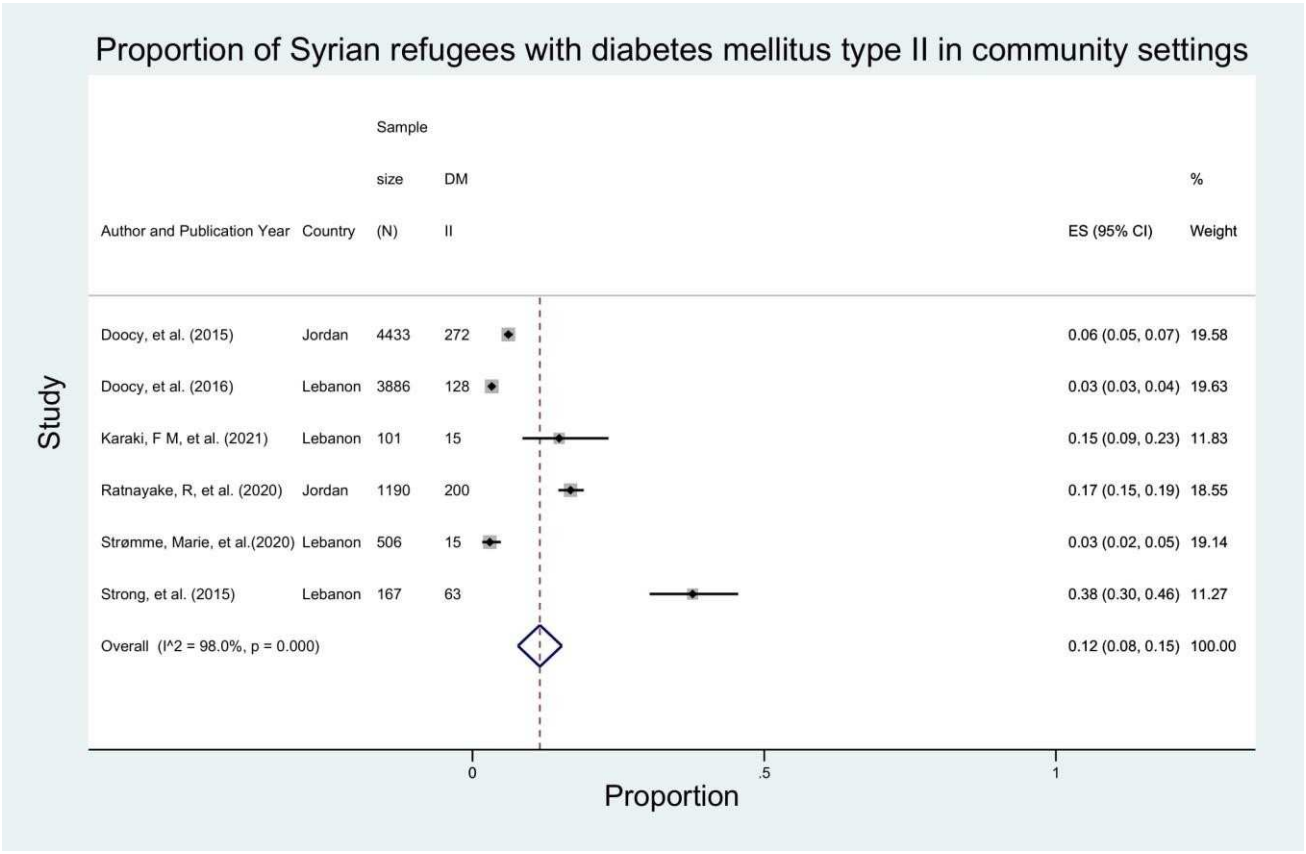


Figure 3. Forest plot showing point estimates with 95% confidence intervals for prevalence of DM II among Syrian refugees in community and primary care settings.



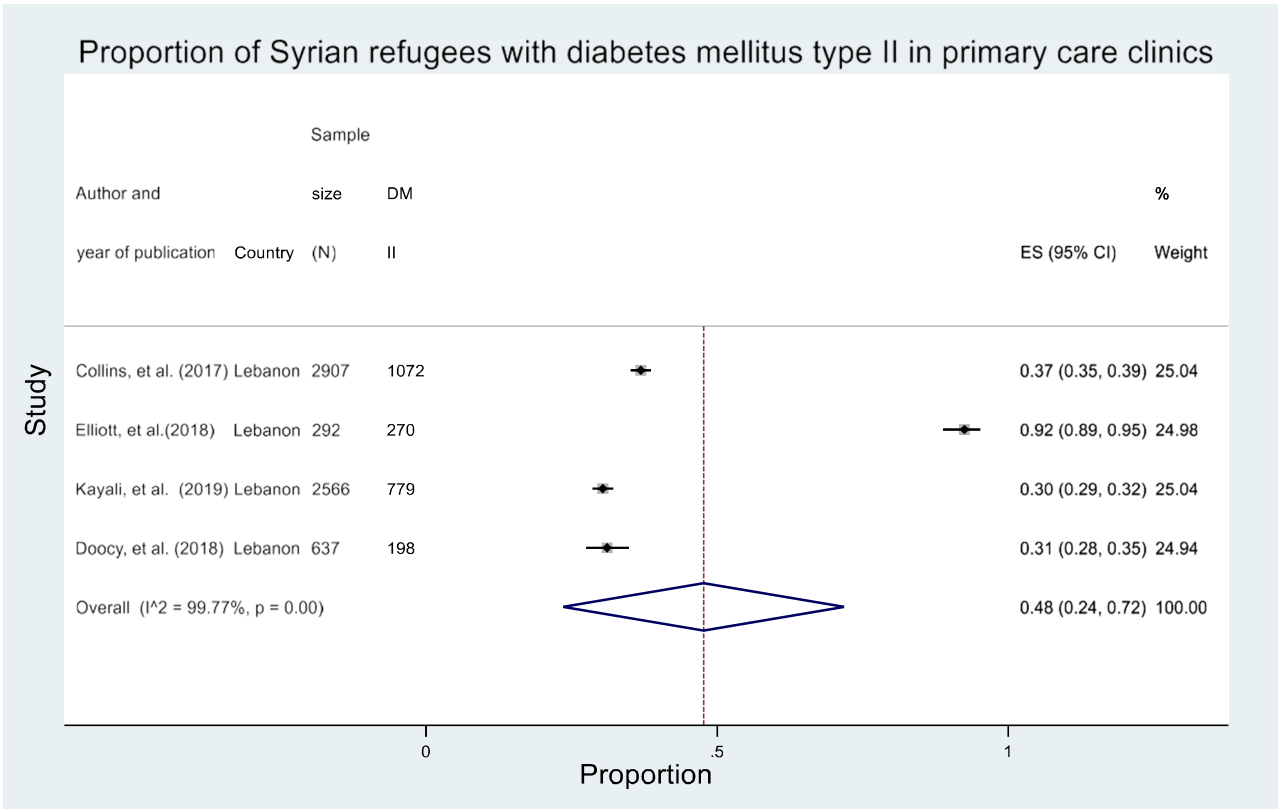
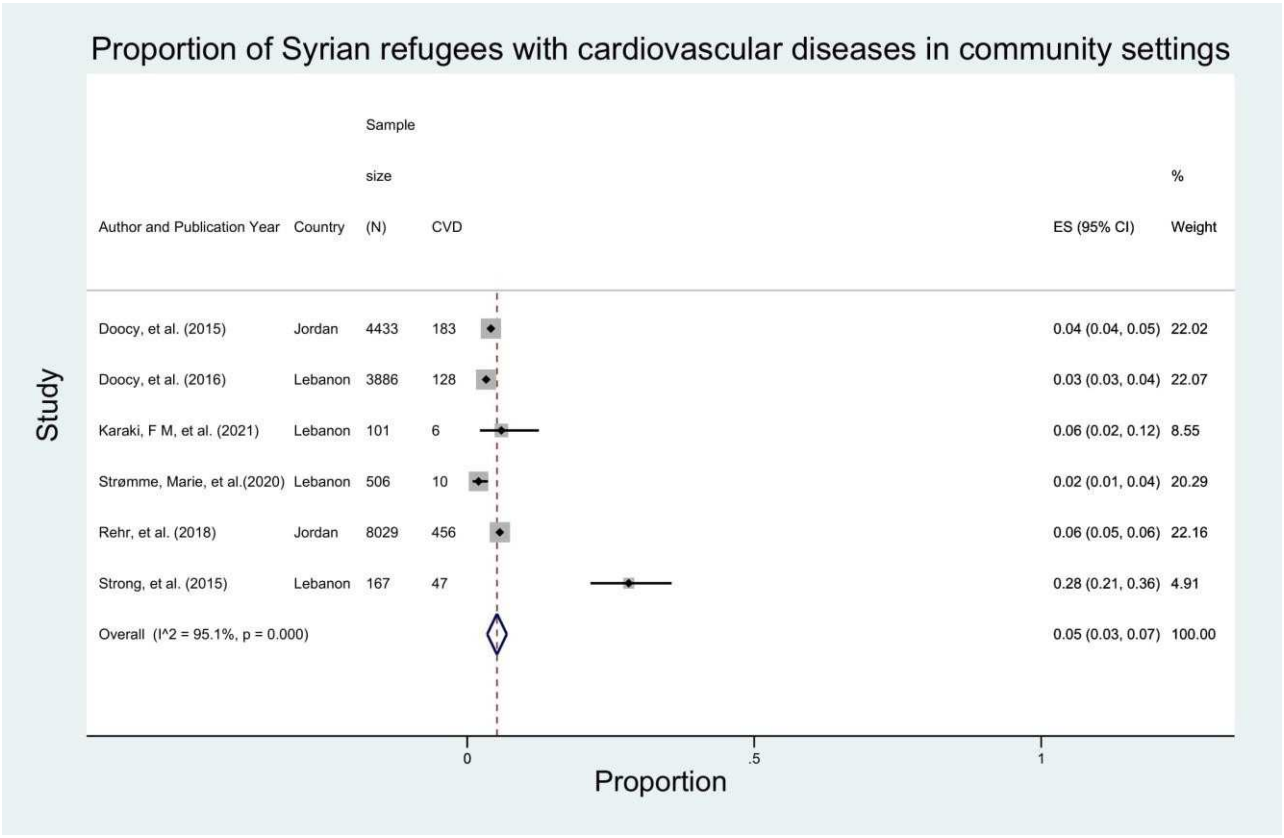


Figure 4. Forest plot showing point estimates with 95% confidence intervals for prevalence of CVDs and CRDs among Syrian refugees in community settings of Syria's neighbouring host countries.



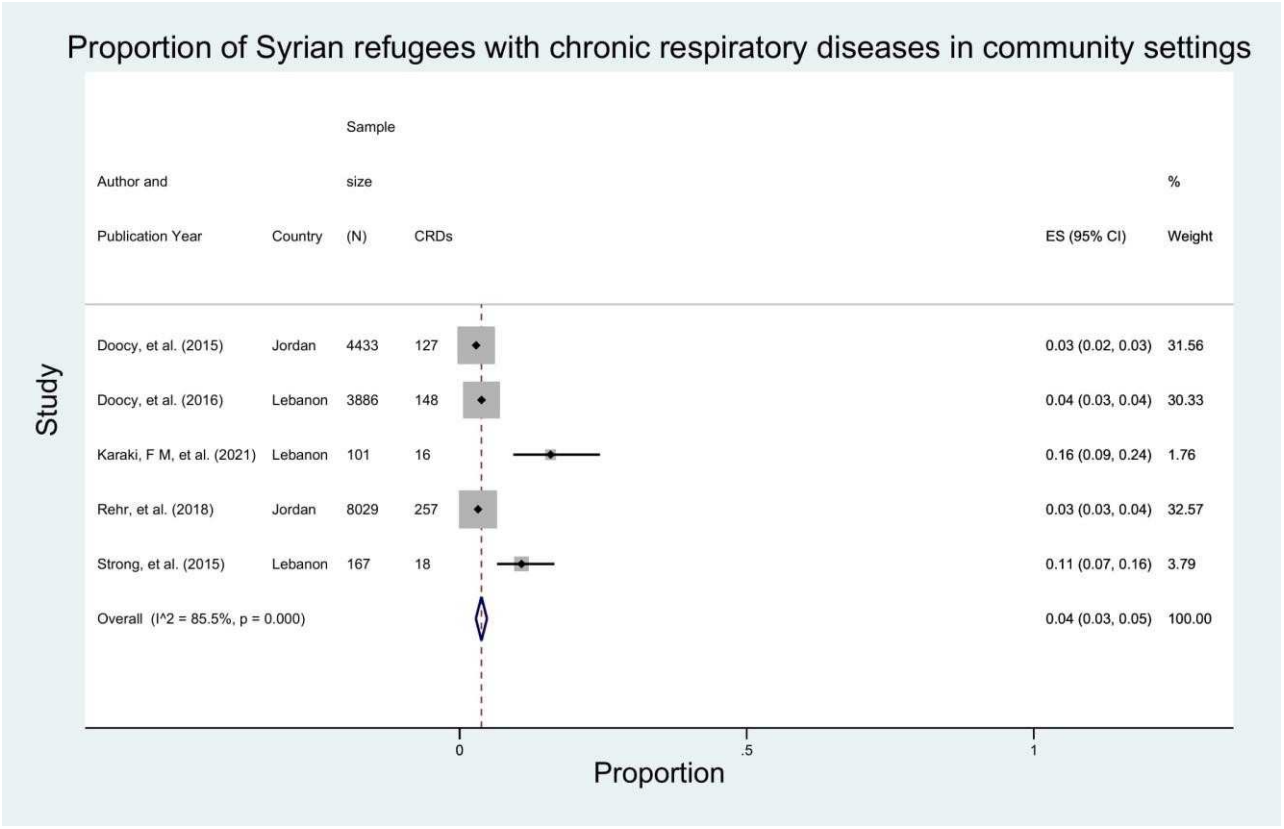
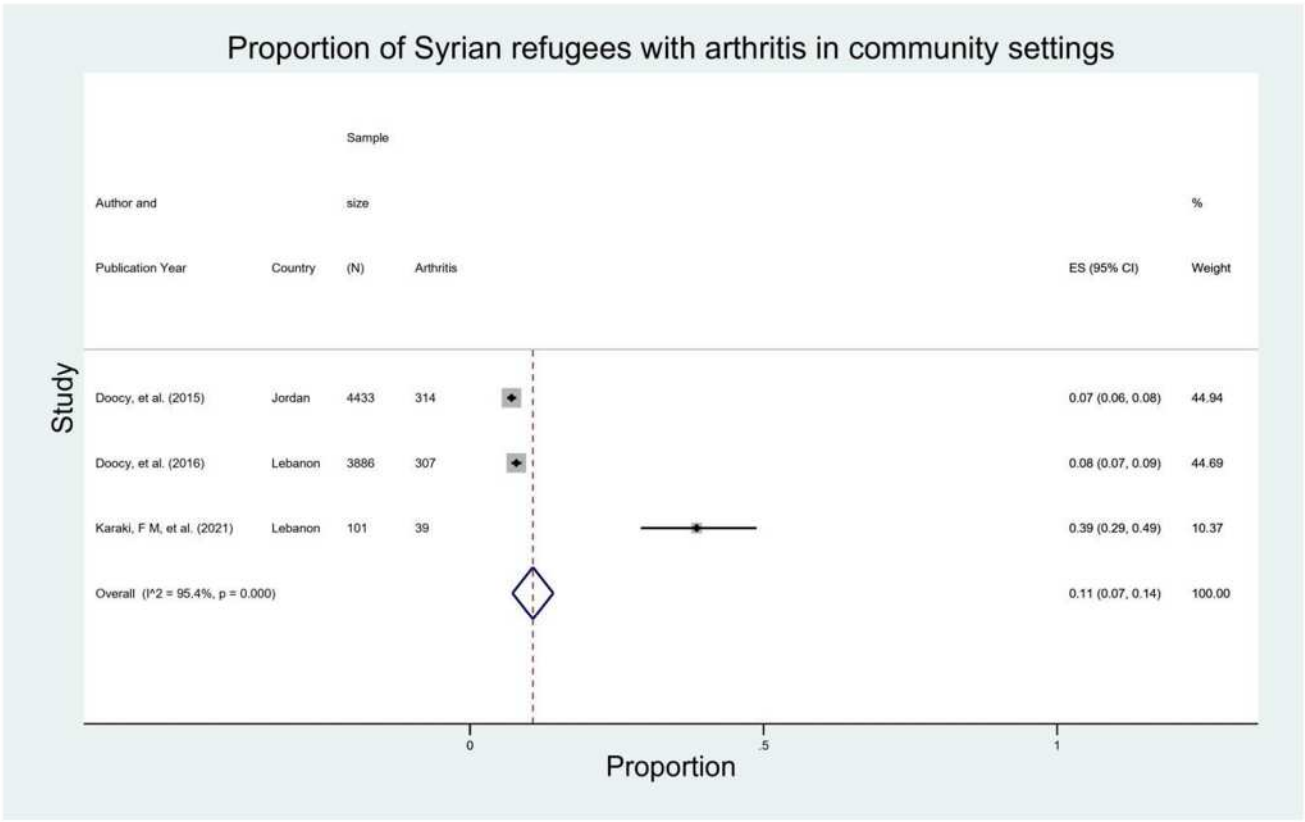


Figure 5. Forest plot showing point estimates with 95% confidence intervals for prevalence of arthritis among Syrian refugees in community settings of Syria's neighbouring host countries.



Discussion

Overall, the meta-analyses showed a high prevalence of the five NCDs among Syrian refugees residing in community settings in Turkey, Lebanon and Jordan. The highest reported prevalence was hypertension (24%), followed by DM II (12%), , CVDs (5%), CRDs (4%) and arthritis (11%). This is concerning, considering that many NCDs are key risk factors for severe COVID-19 infection, and that these factors, when combined with migration-specific factors, increase the risk of infection for refugees. This has been underscored by the COVID-19, both because of the importance of preventing, detecting, and managing NCDs for wider health, and for managing the burden on health systems in the context of the pandemic. Therefore, governments, stakeholders and policymakers involved in the provision of health services for refugees have a crucial opportunity to make use of the momentum created by the pandemic to improve the provision of comprehensive NCD services to refugees. However, equally it is vital that the burden of NCDs in itself is not overlooked, and that the need for continuous care and support for this population are prioritised regardless of the pandemic.

Our results are consistent with what was reported in a previous scoping review 40 in addition to a study conducted in Jordan, which also found that hypertension was the highest reported NCD among adult Syrian refugees (10.7%), followed by DM II (6.1%).[51] Similarly, three recent nation-level surveys, which were not peer-reviewed publications conducted by the UNHCR found that hypertension is the most prevalent

NCD among Syrian refugees (3.7% in Turkey, 23% in Lebanon and 27% in Jordan).[15,19,20] However, there were slight differences in the order of the remaining NCDs in relation to their prevalence in our systematic review compared to other literature. For example, in the national UNHCR survey in Lebanon, CRDs were the second most common NCDs (19%), followed by DM II (16%) and CVDs (14%), while in Turkey and Jordan, the second most common NCD was DM II (2.6% and 19%, respectively). This was followed by CVDs (2.5%) in Turkey and CRDs (14%) in Jordan.[15,19,20] These differences in the prevalence reported for each NCD within this review might be explained by the difference in the healthcare system of each host country for Syrian refugees and the sample size included in these studies. In addition, this review combined data from three different countries, with a lack of uniform measurement in each included study.

The prevalence of hypertension and DM II was much higher in primary care settings than in community settings. This meta-analysis reported that almost half of Syrian refugees visiting primary care clinics had DM II (48%) and approximately one-third had hypertension (35%). These findings are in accordance with a previous study on primary care clinics in Lebanon where about half of the patients had DM II (51.6%).[42] This result was expected because primary care facilities would have a higher population of participants who suffer from health conditions in general and NCDs in particular who are routinely screened for their vitals that include blood pressure and blood glucose levels. There were also significant variations in reported rates of these NCDs across studies, countries and settings, which underscores the challenges in estimating the burden of NCDs in these communities, as well as the likelihood that the burden is often underestimated due to barriers in reaching Syrian refugees in research or healthcare.

Strengths and limitations

This is the first systematic review and meta-analysis which looked at the prevalence of NCDs among Syrian refugees in Syria's neighbouring host countries. Another key strength is that this systematic review and meta-analysis looked at a range of healthcare and community settings to illustrate heterogeneity in available data, and differing rates across these contexts. This highlights the diversity of health needs in this population. The heterogeneity in the meta-analysis could be due to differences in data collection methods used and the settings where included studies were carried out. As with previous systematic reviews and meta-analyses of epidemiological data on migrants, high heterogeneity was expected and did not preclude a meta-analysis.[52,53] This underscores the diversity of these populations, and country contexts, highlighting the need to improve quality and granularity of data, and the need for targeted and tailored responses for these communities. This review also brings attention to the lack of peer-reviewed research which limited a subgroup analysis per age group and host country. The limited available literature may be attributed both to the period of the conflict in Syria, which started in 2011 (i.e., less than ten years ago), as well as barriers in research on the health needs of conflict-affected populations.

Conclusions and recommendations

There is clear evidence of a significant burden of NCDs in these populations. There is an urgent need for targeted and sustainable responses to address both acute and long-term needs to improve individual and public health and ensure the sustainability and effectiveness of health services in these neighbouring host countries going forward in addition to the use of standard methods for measuring community prevalence (e.g., WHO STEPS method of field-based biological measurement for primary NCDs, random sampling of refugee households using established methods, and systematic random sampling of a single or multiple people in a household). Governments, stakeholders and policymakers involved in the provision of health services for refugees have a crucial opportunity to improve the provision of comprehensive NCD services to refugees. They must collaborate to implement rigorous management plans necessary to address and control NCDs among these populations.

Author statements

Ethical approval

Ethical approval was not required for this systematic review and meta-analysis.

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Competing interests

None declared.

Author contributions

AAO, LBN and KC conceptualised and designed the study. AAO wrote the first manuscript, and other authors contributed significantly to the revision of the manuscript. All authors read and approved the final manuscript.

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Appendix I. PRISMA Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	4
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	4
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Supplement materials
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	4
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Supplement materials
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Supplement materials
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	5

Appendix II. Search terms and strategy

1. CINAHL (via EBSCO) *from 1937 to 01 Nov 2021*

Search ID #	Search Terms	Results
S1	((MH "Noncommunicable Diseases") OR "noncommunicable disease*") OR ((MH "Chronic Disease") OR "chronic disease or chronic illness or long term conditions or chronic conditions") OR (non-communicable disease* OR chronic disease* OR NCDs OR NCD") OR (MH "Diabetes Mellitus, Type 2") OR (diabet*) OR (""((elevat * OR increas* OR high OR rais* OR rising) AND (arterial pressure OR blood pressure OR diastolic pressure OR systolic pressure))"") OR "Hypertens*" OR ((MH "Coronary Disease") OR (MH "Heart Diseases") OR "Coronary* OR heart OR cardiac OR cardiovascular* OR cvd OR cad OR stroke OR cerebrovascular accident OR cva OR cerebral vascular event OR cve OR transient ischaemic attack OR tia") OR "ischemic heart disease" OR (MH "Stroke") OR ((MH "Arthritis, Rheumatoid") OR (MH "Arthritis") OR "arthritis or osteoarthritis or rheumatoid arthritis")	809,484
S2	(MH "Syria") OR "syria* OR syrie*"	1,144
S3	(MH "Refugees") OR (MH "Immigrants, Illegal") OR (MH "Transients and Migrants") OR (MH "Refugee Camps") OR (MH "Immigrants") OR (MH "Emigration and Immigration") OR "refuge* or asylum* or displaced or migrants or immigrant* or emmigra*"	32,711
S4	((MH "Jordan") OR "jordan") OR (MH "Turkey") OR turkey country OR (MH "Lebanon") OR "Lebanon"	38,381
S5	S1 AND S2 AND S3 AND S4 [Limiters - Published Date: 20110101-20211231]	26

2. MEDLINE (via Ovid) *from 1946 to 01 Nov 2021*

Search ID #	Search terms	Results
1	(non-communicable disease* or noncommunicable disease* or chronic disease* or NCDs or NCD).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	341,610
2	Noncommunicable Diseases/	2,038
3	Chronic Disease/	271,785
4	Diabetes Mellitus, Type 2/	147,994
5	(MODY or NIDDM or T2DM).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	33,791
6	(non insulin* depend* or noninsulin* depend* or noninsulin?depend*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	12,475
7	(DM Type 2 or DM Type II or DM type two).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	914
8	diabet*.mp.	758,587
9	(copd or chronic obstructive pulmonary disease or chronic obstructive airway disease or chronic obstructive lung disease).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary	73,454

	concept word, rare disease supplementary concept word, unique identifier, synonyms]	
10	Pulmonary Disease, Chronic Obstructive/	44,586
11	Asthma*.mp. or Asthma/	189,989
12	((elevat* or increas* or high or rais* or rising) adj2 (arterial pressure or blood pressure or diastolic pressure or systolic pressure)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	60,356
13	((elevat* or increas* or lower or high or rais* or rising) adj2 (bp or dbp or hbp or sbp)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	15,535
14	Hypertension/ or hypertens*.mp.	545,727
15	(Coronary* or cardiovascular* or cvd or heart or cardiac or cad or stroke or cerebrovascular accident or cva or cerebral vascular event or cve or transient ischaemic attack or tia).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2,470,029
16	Coronary Disease/	131,761
17	Stroke/	114,195
18	((rheumatoid or reumatoid or revmatoid or rheumatic or reumatic or revmatic or rheumat* or reumat* or revmarthrit*) adj3 (arthrit$ or artrit* or diseas* or condition* or nodule*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	186,756
19	(Arthritis or Arithritis).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	234,622
20	Arthritis/	36,236
21	(Syria* or Syrie*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	13,848
22	Syria/	2,174
23	(refuge* or displaced or immigrant* or asylum* or displaced).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	88,389
24	Refugees/	11,587
25	"Emigrants and Immigrants"/	13,763
26	"Transients and Migrants"/	12,879

27	Refugee Camps/	223
28	Lebanon.mp. or Lebanon/	6,086
29	Turkey/ or Turkey.mp.	53,130
30	Jordan.mp. or Jordan/	8,510
31	28 or 29 or 30	73,215
32	23 or 24 or 25 or 26 or 27	98,184
33	21 or 22	13,848
34	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20	4,038,569
35	31 and 32 and 33 and 34	94
36	limit 35 to yr="2011 -Current"	93

3. EMBASE (via Ovid) *from 1974 to 01 Nov 2021*

Search ID #	Search term	Results
1	(non-communicable disease* or noncommunicable disease* or chronic disease* or NCDs or NCD).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	241,110
2	non communicable disease/	6,967
3	chronic disease/	175,847
4	non insulin dependent diabetes mellitus/	254,347
5	(non insulin* depend* or noninsulin* depend* or noninsulin?depend*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	257,916
6	(MODY or NIDDM or T2DM).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	47,452
7	(DM Type 2 or DM Type II or DM type two).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	11,551
8	diabet*.mp.	1,132,234
9	(copd or chronic obstructive pulmonary disease or chronic obstructive airway disease or chronic obstructive lung disease).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	157,737
10	chronic obstructive lung disease/	132,527
11	asthma/ or Asthma*.mp.	290,767
12	((elevat* or increas* or high or rais* or rising) adj2 (arterial pressure or blood pressure or diastolic pressure or systolic pressure)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	78,107
13	((elevat* or increas* or lower or high or rais* or rising) adj2 (bp or dbp or hbp or sbp)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	23,282
14	hypertension/ or hypertens*.mp.	921,965

15	(Coronary* or cardiovascular* or cvd or heart or cardiac or cad or stroke or cerebrovascular accident or cva or cerebral vascular event or cve or transient ischaemic attack or tia).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	3,494,097
16	cardiovascular disease/	268,016
17	cerebrovascular accident/	204,819
18	cerebrovascular disease/	55,070
19	coronary artery disease/	191,018
20	heart disease/	107,341
21	((rheumatoid or reumatoid or revmatoid or rheumatic or reumatic or revmatic or rheumat* or reumat* or revmarthrit*) adj3 (arthrit* or artrit* or diseas* or condition* or nodule*)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	268,114
22	(Arithritis or Arthritis).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	333,785
23	rheumatoid arthritis/ or arthritis/	235,531
24	Syria.mp. or Syrian Arab Republic/	3,341
25	(Syria* or Syrie*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	18,033
26	(refuge* or displaced or immigrant* or asylum* or displaced).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	88,629
27	refugee camp/ or refugee/	12,724
28	undocumented immigrant/ or immigrant/	16643
29	migrant/	7,478
30	asylum seeker/	931
31	lebanon.mp. or Lebanon/	6,853
32	"Turkey (republic)"/	36163
33	Turkey.mp.	70,544
34	Jordan.mp. or Jordan/	9,712
35	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23	5,438,837
36	25 or 26	18,033
37	26 or 27 or 28 or 29 or 30	92,927
38	31 or 32 or 33 or 34	86,048
39	35 and 36 and 37 and 38	291
40	limit 39 to yr="2011 -Current"	229

4. PubMed *from 1996 to 01 Nov 2021*

Search ID #	Query	Results
1	((((((((((((((((((((((((((non-communicable disease* OR noncommunicable disease* OR chronic disease* OR NCDs OR NCD) OR (chronic diseases[MeSH Terms]))	5,924,846

	OR (noncommunicable diseases[MeSH Terms])) OR (diabetes mellitus, non insulin dependent[MeSH Terms])) OR (MODY OR NIDDM OR T2DM)) OR (non insulin* depend* OR noninsulin* depend* OR noninsulin?depend*)) OR (DM Type 2 OR DM Type II OR DM type two)) OR (diabet*)) OR (chronic obstructive pulmonary disease[MeSH Terms])) OR (pulmonary disease, chronic obstructive[MeSH Terms])) OR (chronic obstructive lung disease[MeSH Terms])) OR (copd OR chronic obstructive pulmonary disease OR chronic obstructive airway disease OR chronic obstructive lung disease)) OR (Asthma[MeSH Terms])) OR (Asthma*)) OR (hypertension[MeSH Terms])) OR (((elevat* or increas* or high or rais* or rising) adj2 (arterial pressure OR blood pressure OR diastolic pressure OR systolic pressure)))) OR (((elevat* OR increas* OR lower OR high OR rais* OR rising) adj2 (bp OR dbp OR hbp OR sbp)))) OR (Hypertens*)) OR (coronary heart disease[MeSH Terms])) OR (coronary heart diseases[MeSH Terms])) OR (disease, coronary heart[MeSH Terms])) OR (diseases, coronary heart[MeSH Terms])) OR (Coronary* OR cardiovascular* OR cvd OR heart OR cardiac OR cvd OR cad OR coronary disease* OR cad OR stroke OR cerebrovascular accident OR cva OR cerebral vascular event OR cve OR transient ischaemic attack OR tia)) OR (Stroke[MeSH Terms])) OR (((rheumatoid OR reumatoid OR revmatoid OR rheumatic OR reumatic OR rheumat* OR reumat*) adj3 (arthrit* OR artrit* OR diseas* OR condition* OR nodule*)).)) OR (Arthritis OR Arithritis)) OR (arthritis[MeSH Terms])	
2	(Syria* OR Syrie*) OR (syria[MeSH Terms])	14,160
3	((((((refuge* OR asylum seeker* OR displaced OR immigrant* OR asylum* OR displaced) OR (camp, refugee[MeSH Terms])) OR (camps, refugee[MeSH Terms])) OR (refugee camp[MeSH Terms])) OR (refugee camps[MeSH Terms])) OR (emigrants and immigrants[MeSH Terms])) OR (emigration and immigration[MeSH Terms])	222,131
4	(Lebanon) OR (lebanon[MeSH Terms])	29,427
5	(Turkey) OR (Turkey[MeSH Terms])	261,697
6	(Jordan) OR (jordan[MeSH Terms])	36,307
7	((((Jordan) OR (jordan[MeSH Terms])) OR ((Jordan) OR (jordan[MeSH Terms]))) OR ((Turkey) OR (Turkey[MeSH Terms]))) OR ((Lebanon) OR (lebanon[MeSH Terms]))	326,196

8	((((((((((((((((((((((((((((((((non-communicable disease* OR noncommunicable disease* OR chronic disease* OR NCDs OR NCD) OR (chronic diseases[MeSH Terms])) OR (noncommunicable diseases[MeSH Terms])) OR (diabetes mellitus, non insulin dependent[MeSH Terms])) OR (MODY OR NIDDM OR T2DM)) OR (non insulin* depend* OR noninsulin* depend* OR noninsulin?depend*)) OR (DM Type 2 OR DM Type II OR DM type two)) OR (diabet*)) OR (chronic obstructive pulmonary disease[MeSH Terms])) OR (pulmonary disease, chronic obstructive[MeSH Terms])) OR (chronic obstructive lung disease[MeSH Terms])) OR (copd OR chronic obstructive pulmonary disease OR chronic obstructive airway disease OR chronic obstructive lung disease)) OR (Asthma[MeSH Terms])) OR (Asthma*)) OR (hypertension[MeSH Terms])) OR (((elevat* or increas* or high or rais* or rising) adj2 (arterial pressure OR blood pressure OR diastolic pressure OR systolic pressure)))) OR (((elevat* OR increas* OR lower OR high OR rais* OR rising) adj2 (bp OR dbp OR hbp OR sbp)))) OR (Hypertens*)) OR (coronary heart disease[MeSH Terms])) OR (coronary heart diseases[MeSH Terms])) OR (disease, coronary heart[MeSH Terms])) OR (diseases, coronary heart[MeSH Terms])) OR (Coronary* OR cardiovascular* OR cvd OR heart OR cardiac OR cvd OR cad OR coronary disease* OR cad OR stroke OR cerebrovascular accident OR cva OR cerebral vascular event OR cve OR transient ischaemic attack OR tia)) OR (Stroke[MeSH Terms])) OR (((rheumatoid OR reumatoid OR revmatoid OR rheumatic OR reumatic OR rheumat* OR reumat*) adj3 (arthrit* OR artrit* OR diseas* OR condition* OR nodule*)).)) OR (Arthritis OR Arithritis)) OR (arthritis[MeSH Terms])) AND ((Syria* OR Syrie*) OR (syria[MeSH Terms]))) AND (((((((refuge* OR asylum seeker* OR displaced OR immigrant* OR asylum* OR displaced) OR (camp, refugee[MeSH Terms])) OR (camps, refugee[MeSH Terms])) OR (refugee camp[MeSH Terms])) OR (refugee camps[MeSH Terms])) OR (emigrants and immigrants[MeSH Terms])) OR (emigration and immigration[MeSH Terms]))) AND (((((Jordan) OR (jordan[MeSH Terms])) OR ((Jordan) OR (jordan[MeSH Terms]))) OR ((Turkey) OR (Turkey[MeSH Terms]))) OR ((Lebanon) OR (lebanon[MeSH Terms]))))	120

9	((((((((((((((((((((((((((((((non-communicable disease* OR noncommunicable disease* OR chronic disease* OR NCDs OR NCD) OR (chronic diseases[MeSH Terms])) OR (noncommunicable diseases[MeSH Terms])) OR (diabetes mellitus, non insulin dependent[MeSH Terms])) OR (MODY OR NIDDM OR T2DM)) OR (non insulin* depend* OR noninsulin* depend* OR noninsulin?depend*)) OR (DM Type 2 OR DM Type II OR DM type two)) OR (diabet*)) OR (chronic obstructive pulmonary disease[MeSH Terms])) OR (pulmonary disease, chronic obstructive[MeSH Terms])) OR (chronic obstructive lung disease[MeSH Terms])) OR (copd OR chronic obstructive pulmonary disease OR chronic obstructive airway disease OR chronic obstructive lung disease)) OR (Asthma[MeSH Terms])) OR (Asthma*)) OR (hypertension[MeSH Terms])) OR (((elevat* or increas* or high or rais* or rising) adj2 (arterial pressure OR blood pressure OR diastolic pressure OR systolic pressure)))) OR (((elevat* OR increas* OR lower OR high OR rais* OR rising) adj2 (bp OR dbp OR hbp OR sbp)))) OR (Hypertens*)) OR (coronary heart disease[MeSH Terms])) OR (coronary heart diseases[MeSH Terms])) OR (disease, coronary heart[MeSH Terms])) OR (diseases, coronary heart[MeSH Terms])) OR (Coronary* OR cardiovascular* OR cvd OR heart OR cardiac OR cvd OR cad OR coronary disease* OR cad OR stroke OR cerebrovascular accident OR cva OR cerebral vascular event OR cve OR transient ischaemic attack OR tia)) OR (Stroke[MeSH Terms])) OR (((rheumatoid OR reumatoid OR revmatoid OR rheumatic OR reumatic OR rheumat* OR reumat*) adj3 (arthrit* OR artrit* OR diseas* OR condition* OR nodule*)).)) OR (Arthritis OR Arithritis)) OR (arthritis[MeSH Terms])) AND ((Syria* OR Syrie*) OR (syria[MeSH Terms]))) AND (((((((refuge* OR asylum seeker* OR displaced OR immigrant* OR asylum* OR displaced) OR (camp, refugee[MeSH Terms])) OR (camps, refugee[MeSH Terms])) OR (refugee camp[MeSH Terms])) OR (refugee camps[MeSH Terms])) OR (emigrants and immigrants[MeSH Terms])) OR (emigration and immigration[MeSH Terms]))) AND (((((Jordan) OR (jordan[MeSH Terms])) OR ((Jordan) OR (jordan[MeSH Terms]))) OR ((Turkey) OR (Turkey[MeSH Terms]))) OR ((Lebanon) OR (lebanon[MeSH Terms]))) **Filters: from 2011 - 2021**	118

Appendix III. Additional Information on Methods

Eligibility criteria

The inclusion criteria were determined following the guidance of the Joanna Briggs Institute's (JBI) reviewers' manual for reviews assessing prevalence data. The themes in the review topic were defined using the CoCoPop mnemonic (Condition, Context and Population) to assess prevalence data as detailed below. No restrictions were applied on publication language.

Condition

The review included studies reporting prevalence data in which the outcome included at least one of the five most common NCDs in the target population. The conditions included hypertension, DM II, CVDs, CRDs (COPD and asthma), or arthritis as reported by each study.

Context

To cover both the community setting and the clinical field, studies that were conducted in the households of individuals who reside in refugee camps were included, as were studies conducted in the households of those who live in rural and urban areas outside of refugee camps. The review also included studies of those who had been treated in primary care, secondary care, and tertiary care clinics as well as hospitals that provide Syrian refugees with health services.

Types of participants (population)

The review included studies conducted among male and female adult (i.e., over 18 years old) Syrian refugees (both registered and non- registered) residing in Turkey, Lebanon or Jordan. According to the UNHCR global trends of forced displacement, almost four out of every five refugees worldwide resides in neighbouring countries. Furthermore, Turkey, Lebanon and Jordan host the highest percentages of Syrian refugees, justifying the selection of these countries in this review.

Types of studies

Peer-review supports the trustworthiness and quality of published data. Accordingly, all published peer-reviewed papers reporting any primary data on the prevalence of NCDs among Syrian refugees, such as mixed- methods studies and observational study designs, including cross- sectional studies, retrospective and prospective cohort studies and case- control studies, were included.

Studies such as case series or reports and qualitative study designs were excluded as they did not report the prevalence data required for this review.

Data sources

A scoping search of the MEDLINE and EMBASE databases was carried out via Ovid in April 2020 as an initial step to review the key terms used to describe the articles. These two databases are the preferred primary sources in this review as they complement each other to provide broad coverage of the available literature. To ensure a comprehensive search of the literature, the following databases were last searched on 01 Nov 2021: MEDLINE (via Ovid) from 1946, CINAHL (via EBSCO) from 1937, EMBASE (via Ovid) from 1974 and PubMed database from 1996.

PubMed was searched in addition to MEDLINE because it included updated citations from journals that had not yet been indexed in MEDLINE as well as records from journals that had only been partially indexed in MEDLINE.

Search

The PRISMA-Search Reporting Extension (PRISMA-S) and the Peer Review of Electronic Search Strategies (PRESS) Evidence-Based Checklist were used to ensure the search strategy covered the review question appropriately. A Boolean search strategy was used with a combination of Medical Subject Headings (MeSH) and relevant text words to systematically search for relevant studies. Search terms were related to the NCDs of interest (non-communicable disease*, Hypertens*, Diabet*, Arthrit*, Asthma*, COPD, CVD), refugees (transient*, refuge*, migrant*, immigrant*, asylum*, displaced), Syrians (Syrie* or Syria*) and the three host countries (Turkey, Lebanon, Jordan). The asterisk was used for abridged terminology.

The reference lists of included studies and any relevant systematic reviews were checked manually to identify additional eligible studies. An alert was set in PubMed to allow the author (AA) to remain up to date with the medical literature currently being published.

The methodological quality of individual studies

Methodological quality of studies was assessed in relation to sampling strategy, data collection and statistical analysis. To determine the quality of individual studies, the number of ‘Yes’ responses was divided by the total number of questions to calculate the ‘% of Yes’. To examine gaps in key methodological areas across the studies, the percentage of studies that adequately met each question was calculated ‘Total % of Yes’. This was done by dividing the number of ‘Yes’ responses for each question by the total number of studies.

Data items

For each eligible study, data items including citation details (e.g., the title, authors' names, authors' contact details, year of publication, and journal name) and study characteristics (e.g., the study design, country, setting/context and data collection years with a start and end date) were extracted. In addition, participant characteristics relevant to the selection criteria, sample size (N), mean age (SD), median age (IQR), sex, type(s) of NCDs, number of cases reported for each NCD (n) and prevalence percentage with 95% confidence intervals (CIs) were extracted where available. Data were extracted in a 2 × 2 table format where possible.

Primary outcomes

Studies that reported on the prevalence of NCDs in our target population were included regardless of the type of reporting which included, self-reporting, specific diagnostic criteria for HTN (i.e., systolic blood pressure ≥ 140 and/or diastolic blood pressure ≥ 90 mmHg or currently on medication for raised blood pressure), and biologically based prevalence (i.e., measuring blood pressure and glucose levels).

Data synthesis

For the data synthesis, studies that met the inclusion criteria were categorised into the three following settings: studies conducted in community settings, primary care clinics and emergency departments or tertiary hospitals. Studies that reported on the prevalence of NCDs in community or primary care settings with sufficient data (i.e., at least two studies), were included in the meta-analysis in line with the second objective. Where meta-analysis was deemed inappropriate, narrative synthesis was conducted with a descriptive summary and data tables were presented. The reasons for excluding studies from the meta-analysis were reported.

A meta-analysis of the data was carried out using STATA 16 (Stata Corp LLC, Texas, USA) to examine pooled prevalence either in community or primary care settings which most reflect prevalence in the general population. The *metaprop* command—a statistical command in STATA—was used to perform meta- analyses of prevalence. Random-effects models were utilised due to variability across the studies. Pooled estimates of the prevalence of NCDs across the studies by setting were calculated using 2 × 2 tables. The proportion or percentage of individuals in each study sample with each NCD of interest was pooled and 95% CIs was calculated to produce the estimated proportion across studies. Where a study reported the prevalence as a percentage (% prevalence), the number of cases (n) was calculated by hand using the following formula:

$$Number\ of\ cases\ (n) = \frac{\%\ Prevalence\ \times\ Sample\ size\ (N)}{100}$$

Assessment of heterogeneity

Heterogeneity was assessed through the use of the I^2 statistic. The wide variation in effect estimates was expected owing to varied sample sizes, settings/contexts, study country, and data collection years. Nonetheless, because one of the objectives of this review was to estimate the overall prevalence of NCDs across three countries, the high levels of heterogeneity did not hinder meta-analysis and aligns with approaches in this field.

Risk of bias across studies

Where fewer than ten studies are present in a meta-analysis, tests for funnel plot asymmetry are not recommended. Evidence also suggests that publication bias is unlikely to be an issue for non-comparative studies (i.e., studies included in meta-analyses of proportions. Nevertheless, trends in prevalence in relation to study size and publication date were visually examined and findings were compared with evidence outside the peer-reviewed literature to explore the risk of publication bias.

Additional analyses

Where meta-analysis was deemed inappropriate, a narrative synthesis of the prevalence of NCDs was presented in relation to host country, including tables, where appropriate.

Author and year of publication	Setting/Country	Syrian Sample size N	Hypertension n (%)	DM II n (%)	CVD n (%)	CRD n (%)	Asthma n (%)	COPD n (%)	Arthritis n (%)
Gammouh, O, et al. (2015)[49]	Primary care clinic / Jordan	765	Previously diagnosed NCD = 229 (30) NCD developed in Jordan = 204 (28)						
Hani, A, et al. (2019)[54]	Tertiary hospital/Jordan	969	584 (60)	308 (32)	695 (72)	-	-	-	-
Kurtuluş, Ş, et al. (2018)[51]	Emergency department/Turkey	191,034	-	-	-	-	1760 (1)	763 (0.4)	-
Şahin, M, et al. (2018)[29]	Tertiary hospital/Turkey	67	24 (36)	22 (33)	38 (57)	-	-	9 (13)	-
Sengoren Dikis, O, et al. (2020)[52]	Emergency department/Turkey	14,262	-	-	-	-	93 (1)	9 (0.1)	-
Truppa, C, et al. (2019)[53]	Households /Lebanon	413	Total NCDs = 152 (34)						
	Primary care clinic/Lebanon	177	Total NCDs = 40 (23)						

n: *number of cases*

Appendix IV. Studies excluded from the meta-analysis

Appendix V. Critical appraisal of included studies

Author and year of publication	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	(%) Yes
Collins, D, et al. (2017)	N	Y	Y	Y	Y	Y	Y	Y	Y	89
Doocy, S, et al. (2018)	Y	Y	N	Y	Y	U	U	Y	Y	67
Doocy, S, et al. (2016)	Y	Y	Y	Y	N	N	U	Y	Y	67
Doocy, S, et al. (2015)	Y	Y	Y	Y	Y	N	U	Y	Y	78
Elliott, J, et al. (2018)	N	N	Y	Y	Y	Y	Y	Y	Y	78
Eryurt, M, and Mevlüde G. (2020)	Y	Y	Y	Y	Y	Y	Y	N	Y	89
Gammouh, O, et al. (2015)	N	Y	Y	Y	N	U	Y	Y	Y	67
Hani, A, et al. (2019)	N	N	U	Y	U	Y	U	N	U	22
Karaki, F M, et al. (2021)	Y	Y	U	Y	Y	N	Y	N	U	56
Kayali, M, et al. (2019)	Y	Y	N	Y	Y	N	Y	Y	U	67
Kurtuluş, Ş, et al. (2018)	N	N	N	Y	Y	Y	NA	N	NA	33
Ratnayake, R, et al. (2020)	N	Y	Y	Y	Y	Y	Y	Y	Y	89
Rehr, M, et al. (2018)	N	Y	Y	Y	Y	N	Y	Y	Y	78
Şahin, M, et al. (2018)	Y	U	U	Y	N	Y	Y	Y	U	56
Sengoren Dikis, O, et al. (2020)	Y	N	Y	Y	Y	Y	Y	Y	Y	89
Strømme, E, et al. (2020)	Y	Y	U	N	N	Y	U	Y	N	44
Strong, J, et al. (2015)	Y	N	Y	Y	Y	N	Y	Y	Y	78
Truppa, C, et al. (2019)	Y	N	Y	Y	Y	U	Y	Y	Y	78
Total (%) Yes	61	61	61	72	72	50	67	78	67	

***Y**: Yes; **U**: Unclear; **N**: No; **NA**: Not Available*
JBI critical appraisal questions:
***Q1.** Was the sample frame appropriate to address the target population?*
***Q2**. Were study participants sampled in an appropriate way?*
***Q3**. Was the sample size adequate?*
***Q4.** Were the study subjects and the setting described in detail?*
***Q5**. Was the data analysis conducted with sufficient coverage of the identified sample?*
***Q6**. Were valid methods used for the identification of the condition?*
***Q7**. Was the condition measured in a standard, reliable way for all participants?*
***Q8**. Was there appropriate statistical analysis?*
***Q9**. Was the response rate adequate, and if not, was the low response rate managed appropriately?*

Appendix VI. Summary justifications for the critical appraisal answers

Author and Year of publication	Total N	Reasons for "N"	Total U	Reasons for "U"	Total NA	Reasons for "NA"

Collins, D, et al. (2017)	1	-The study's main aim was to evaluate the use of CVD risk-based prevention strategies in humanitarian settings. However, the sample frame may not be appropriate to address the target population as they looked at clinical populations only.	0	–	0	–
Doocy, S, et al. (2018)	1	-Sample size was not adequate. A total of 1,010 participants were enrolled while the sample size calculation showed 1,609 participants should be recruited.	2	-No details about how measurements of outcomes were taken. - No details about the interviewers.	0	–
Doocy, S, et al. (2016)	2	-Excluding the South governorate clusters from the analysis may introduce coverage bias. -Cases were identified through self-reported diagnosis of the condition from a health professional.	1	-It was mentioned that interviewers received two days of classroom training. However, no description of their roles or education or the consistency of collecting the data was mentioned.	0	–
Doocy, S, et al. (2015)	1	-Respondents were asked about the five conditions reported to be most common among the Syrian refugee population in Jordan. -Diagnosis was self-reported; no documentation was required to verify the conditions.	1	-It was mentioned that the interviewers underwent training. However, their level of education or how the measurement was conducted was not mentioned.	0	–

Elliott, J, et al. (2018)	2	-The study took place in Bakaa Valley where only 35% of the total number of Syrian refugees reside, which could make the results not representative of the general population. - All patients meeting inclusion criteria were opportunistically sampled in the clinics on days a data collector was present in clinic, which may not provide a representative sample of the base population.	0	–	0	–
Eryurt, M, and Mevlüde G. (2020)	1	-The numerator and denominator were clearly reported, and percentages were given but without confidence intervals. -The p-value and odds ratio were also reported and it was mentioned that it will be descriptive analysis. However, the methods section was not detailed enough to identify the analytical technique used.	0	–	0	–
Gammouh, O, et al. (2015)	2	-Convenience sampling introduces selection bias in the target population of the study. As such, the sample frame did not seem appropriate to address the target population.	0	–	0	–
Hani, A, et al. (2019)	3	-The numerator and denominator were clearly reported. However, confidence intervals were not provided. -The methods section did not give any details about the analytical techniques used and how specific variables were measured.	4	-There was no evidence that the authors conducted a sample size calculation to determine an adequate sample size. -The response rate description was not reported. -There was no description of how the measurement was conducted or how variables were measured.	0	–

Ratnayake, R, et al. (2020)	1	The study took place in Northern Jordan , and for Syrian refugees from Southern Syria only, which could make the results not representative of the general population.	–	–	–	–
Karaki, F M, et al. (2021)	2	-Cases were identified through self-reported diagnosis of the condition from a health professional. - Confidence intervals were not provided.	2	-There was no evidence that the authors conducted a sample size calculation to determine an adequate sample size. -The response rate description was not reported.	0	–