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Healthy Urban Environments

Clinical Academic Group

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The HUE Collaboratory exists to improve the health of Australians living in urban environments.

We achieve this by facilitating partnerships between those who shape and have an impact on cities.

These partnerships undertake research and activities to build our understanding of how urban environments can deliver better, more equitable health outcomes.

We will use this understanding to inform government policy and practice in the planning and development of urban areas.

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Introduction

With the continued and increasing emphasis on the relationship between the built environment and human health, a number of assessment and audit tools have been developed to ascertain these co-dependent relationships. These tools aim to assist policymakers and researchers to systematically appraise features in the built environment that may aid or hinder the spread of diseases or otherwise encourage behaviours that may affect health negatively, and design interventions to curtail these negative impacts correspondingly. Some of these tools have an added emphasis on health promotion, by highlighting features and processes that enhance human health positively.

The nature and scope of the proposed (and occasionally, empirically applied) tools are vast. In Australia, these include:

- The *Health Facility Audit Tool* by NSW Health's Mid North Coast Local Health District, which is a condensed checklist adopted from the *WELL Building Standard checklists*, and the Heart Foundation's *Healthy Active by Design Key Design Features* and *PCAL Development and Active Living – Developers Checklists*.
- *Health impact assessments*, including a comprehensive practical guide published by UNSW Sydney's Centre for Health Equity Training, Research and Evaluation, which provides guidance on how to establish and undertake a health impact assessment of existing and proposed built environment projects. As the guideline notes, it is "both a health protection and health promotion tool" (Harris et al. 2007:5) where both health hazards (such as the use of carcinogenic materials) and health benefits (such as fresh air from cross-ventilation) may be identified.

Internationally, other existing examples include:

- *The WELL Building Standard checklist* by the International WELL Building Institute, which comprises 103 features across 8 domains, and the means to which each feature may be assessed on-site (e.g. performance measure, visual inspection). The checklist is aimed at transforming the building industry to develop strategies "to enhance human health and well-being" (IWBI 2020:1).
- The US Centers for Chronic Disease Prevention and Health Promotion's *Built Environment Assessment Tool* (US CCDPHP 2015:1), which is "a direct systematic observation data collection instrument for measuring the core features and quality of the built environment related to behaviours that affect health, especially behaviours such as walking, biking, and other types of physical activity".

These assessment and audit tools are important in helping designers and policymakers to identify the current state of an area or infrastructure in focus in relation to health hazards and enhancements. They are designed for ease of use and can be applied across different contexts, though currently mostly to individual buildings or residential and mixed use neighbourhoods rather than specialised developments like a health precinct.

Rationale

As Rampuria et al. (2022) highlight, the COVD-19 pandemic has exposed the growing inadequacy of our healthcare facilities, both in terms of their ability to sufficiently responding to major health emergencies like a pandemic, and to promote health and wellbeing to safeguard us from overwhelming the health system. Consequently, they propose nine principles for (re)designing health facilities (nominally hospitals) "to support radically improved patient experiences, clinical outcomes, staff wellbeing, and integration with wider health and social care, in environmentally sustainable and economically feasible ways."

While making no explicit references to the four assessment and audit tools that are the focus of this rapid review, the nine principles proposed have notable overlaps with the features included and highlighted by the relevant checklists and tools.

Health precincts are, however, more than just a collection of co-located health facilities that provide different but co-related functions. They represent unique opportunities to concentrate and disseminate capabilities for better health. As Rampuria et al. (2022) point out, they are "geographically based integrated care systems incorporating primary, community, and secondary care facilities" that collectively work as "more than the sum of its parts." How precisely they work, and what would be the ideal balance of investment in precinct hardware (e.g. buildings, connecting infrastructure, green spaces) and software (e.g. usage patterns, wayfinding, human resources) is a constant quest among a multitude of stakeholders. This is because health precincts are vital places of healthcare where:

1. People with existing health conditions and compromised immunity—and their family, friends and other visitors—attend;
2. Recovering patients who could most benefit from health-enhancing features patronise; and
3. Workers in high stress and high demand roles frequent.

Health precincts, therefore, are regularly attended by people—as well as those who stay within the precinct for extended periods—from broad geographic and wide socioeconomic backgrounds, experiencing various health conditions.

Existing literature, including grey literature, typically reflect on hazard-reducing and/or health-promoting interventions that are designed for residential neighbourhoods. As Koohsari et al. (2015) note, "to date no study has examined the relationship between public open space and physical activity in non-residential contexts", including and especially the very mixed use and mixed patronage space of health precincts. The increased risk of exposure to diseases and other hazards, and the vital functions precinct workers perform to help curtail these hazards and risks, mean that, therefore, a health-promoting environment is even more pertinent given this increased vulnerability.

A strong programme logic, or conceptual mapping, of the dimensions of Healthy Precinct Planning would critically enhance disease prevention and health promotion at structural and systematic levels. The resultant outcomes could facilitate governments and built environment industries establish regional, national and international benchmarks for designing, constructing and monitoring health precincts that not only aid the recovery from diseases and injuries but also safeguard and improve the personal and environmental health of their occupants, including (but not limited to) patients and their family, other visitors, and workers.

Objective

To facilitate the above, and in the absence of assessment and audit tools specifically designed for application at health precincts, this rapid systematic review of literature has the following objective:

- to assess the suitability of four abovementioned audit tools—at the building and neighbourhood levels—for application at health precincts.

Methods

Eligibility criteria

Following study characteristics were used as criteria for eligibility for the inclusion in the final set of studies synthesised via a rapid systematic review process:

1. **Publication year**: studies published in and after 2010 (last 12 years)
2. **Publication type**: studies published as peer-reviewed articles, postgraduate theses and reports by major credible organisations (governmental, research institutes, peak bodies)
3. **Publication language**: studies published in English
4. **Study type**: secondary studies
5. **Study topic**: the main focus of the study is on summarising key characteristics, advantages, limitations, and other relevant aspects of the four predefined target audit/assessment tools capturing the relationship between the built environment and human health
6. **Study geographical focus**: any

An iterative process was considered during the actual review process to refine the above criteria:

Scaling up: Where fewer than 5 studies were eligible for inclusion in the review were identified using the combined eligibility criteria 1-5 for any of the four predefined tools, we included case studies on the applications of that predefined target audit/assessment tool if they included critical assessment of the tool performance.

Scaling down: Where 20 or more studies eligible for inclusion in the review were identified using the combined eligibility criteria 1-5, we only included peer-reviewed articles.

Information sources

1. Scopus
2. Web of Science
3. Medline (via Web of Science)
4. Embase (OVID)
5. CINAHL (EBSCOhost)
6. BASE
7. Cochrane Library
8. ProQuest
9. WorldWideScience
10. From the studies included from the above searches, we conducted forward (citing studies) and backward (cited studies) reference searches using the Scopus platform. We also used the “related studies” function in Google Scholar to find similar studies
11. An additional search was conducted using Google Scholar

Literature search and study records

To construct search strings, we used keywords and phrases related to the setting, population, tools, intervention or type of study, as well as name of the four target audit/assessment tools, as feasible within each of the information sources (databases/search engines). All main database searches were run on 19/04/2022 (Figure A1). Number of “hits”, reported after the search sting and filters used, refers to the number of bibliographic references found, for each search and each data source:

1. Search string for the SCOPUS online database, advanced search: TITLE-ABS-KEY ("WELL Building Standard*" OR "Health Facility Audit Tool" OR "health impact assessment practical guide" OR "Built Environment Assessment Tool") OR TITLE-ABS-KEY (("Building Standard*" OR "Built Environment" OR precinct*) AND (medical* OR hospital* OR health* OR wellbeing OR well-being) AND (assessment* OR audit* OR checklist* OR standard*) AND ("city planning" OR "environmental planning")) **[408 hits]**
2. Search string for the Web of Science online database, advanced search: TS = ("WELL Building Standard*" OR "Health Facility Audit Tool" OR "health impact assessment practical guide" OR "Built Environment Assessment Tool") OR TS = (("Building Standard*" OR "Built Environment" OR precinct*) AND (medical* OR hospital* OR health* OR wellbeing OR well-being) AND (assessment* OR audit* OR checklist* OR standard*) AND ("city planning" OR "environmental planning")) Indexes=SCI-EXPANDED, SSCI, AHCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years **[34 hits]**
3. Search string for the Medline (via WoS) online database, advanced search: TS = ("WELL Building Standard*" OR "Health Facility Audit Tool" OR "health impact assessment practical guide" OR "Built Environment Assessment Tool") OR TS = (("Building Standard*" OR "Built Environment" OR precinct*) AND (medical* OR hospital* OR health* OR wellbeing OR well-being) AND (assessment* OR audit* OR checklist* OR standard*) AND ("city planning" OR "environmental planning")) Timespan=All years **[60 hits]**
4. Search string for the Embase (OVID) online database, advanced search: ("WELL Building Standard*" or "Health Facility Audit Tool" or "health impact assessment practical guide" or "Built Environment Assessment Tool").af. Expanders = Also search within the full text of the articles **[1 hit]**
5. Search string for the CINAHL (EBSCOhost) online database, advanced search: TX "WELL Building Standard*" OR TX "Health Facility Audit Tool" OR TX "health impact assessment practical guide" OR TX "Built Environment Assessment Tool" Expanders = Also search within the full text of the articles **[1 hit]**
6. Search string for the BASE online database, advanced search: ("WELL Building Standard" OR "Health Facility Audit Tool" OR "health impact assessment practical guide" OR "Built Environment Assessment Tool") doctype:(12* 14 15 18* 19) Expander = Entire document **[37 hits]**
7. Search string for the Cochrane Library online database, advanced search: ("WELL Building Standard*" OR "Health Facility Audit Tool" OR "health impact assessment practical guide" OR "Built Environment Assessment Tool" OR "Building Standard*" OR "Built Environment" OR "precinct" OR "city planning" OR "environmental planning") in All Text - (Word variations have been searched), Cochrane Reviews **[15 hits]**
8. Search string for the ProQuest online database, advanced search: ("WELL Building Standard*" OR "Health Facility Audit Tool" OR "health impact assessment practical guide" OR "Built Environment Assessment Tool") Expanders: Anywhere Additional limits - Document type: Article, Literature Review, Report, Review, Standard **[180 hits]**
9. Search string for the WorldWideScience online database, advanced search: ("WELL Building Standard*" OR "Health Facility Audit Tool" OR "health impact assessment practical guide" OR "Built Environment Assessment Tool") Language = English Document type = Papers **[47 hits]**
10. Search string for the Australian Policy Observatory online database, separate searches (no advanced search functionality): *"WELL Building Standard"* **[116 hits]**, *"Health Facility Audit Tool"* **[0 hits]**, *"health impact assessment practical guide"* **[9 hits]**, *"Built Environment Assessment Tool"* **[17 hits]** (Note: no export functionality)
11. Scopus forward and backward searches – based on citation links, not search string. **[320 hits, 03/06/2022]**

12. Search string for Google Scholar search engine: "WELL Building Standard" OR "Health Facility Audit Tool" OR "health impact assessment practical guide" OR "Built Environment Assessment Tool" Limits: 2010-2022, Review articles, Exclude citations **[95 hits]**

The study records found from the searches in online databases were exported as bibliographic files. After removing duplicates, title and abstracts were independently screened by EL, ML and AR to identify relevant studies using the inclusion/exclusion criteria described in the earlier section of this protocol. Full papers were then retrieved for studies deemed potentially relevant. Two reviewers (EL, ML) independently performed screening of full papers by using same criteria as for the titles and abstracts. Resulting included studies were used to perform additional searches for missed papers (forward and backward reference screening and related papers in Google Scholar, 320 unique hits). For the additional references, titles were scanned first, then duplicates removed, abstracts and finally full papers assessed for inclusion. Data was extracted by EL, and checked by ML, using a data extraction sheet created in Microsoft Excel and pre-tested with two included papers.

Data items

We recorded the following study characteristics: study title, author, year of publication, study type (e.g., review, case study), geographic scope (e.g., Australia, Europe, global), aims, types of audit/assessment tool considered, type of outcomes considered, key findings, study funding sources and conflict of interests (as stated by the study authors).

Table 1 presents the main extracted variables and their values/codes (also used in Table 2 in the Results section).

Table 1: List of the main study variables extracted and coded for the included studies, with relevant values.

Study variable	Description
First author_year	Key (ID) of the article is created by concatenating the last name of the first author and the year published
Title	Title of article
Publication type	Type of publication, including SJR journal ranking quartile of the corresponding publication year where relevant
Audit tool	Audit tool(s) specifically discussed in the article
Geographic focus	Main countries/regions addressed in the article
Intervention target	Type of intervention reported in the article
Audit tool assessments and comparisons	Type of approach to assessing the audit tools reported
Study funding; Conflict of interest	Funding sources declared in the article; Conflicts of interests declared in the article

Outcomes and prioritisation

During the study selection process, we prioritised peer-reviewed studies focused on audit tools in the contexts related to designing, constructing and monitoring health precincts.

Studies that focused only on one specific intervention or health aspect (e.g. walkability, sustainability) were excluded. Studies that focused only on residential neighbourhoods were also excluded.

Risk of bias in individual studies

We recorded methodological approaches used in the included studies (e.g. narrative review, systematic-like review, empirical comparison of results of multiple audit/assessment tools, case study of a single tool, etc.). We also considered information on the sources of funding and acknowledged conflicts of interests from the included studies. Given the expected diversity of included study types, no other formal assessment of Risk of Bias was possible.

Meta-bias(es)

Not applicable, due to the scoping nature of this review and focus on secondary studies only.

Results

The final study list includes 26 papers that fulfilled our inclusion criteria and is presented in Table 2. These papers represent a mix of international literature written in English that critically assessed the merits and drawbacks of these four key audit tools (including comparing across multiple audit tools) for application across a range of built environments.

Overview of included studies

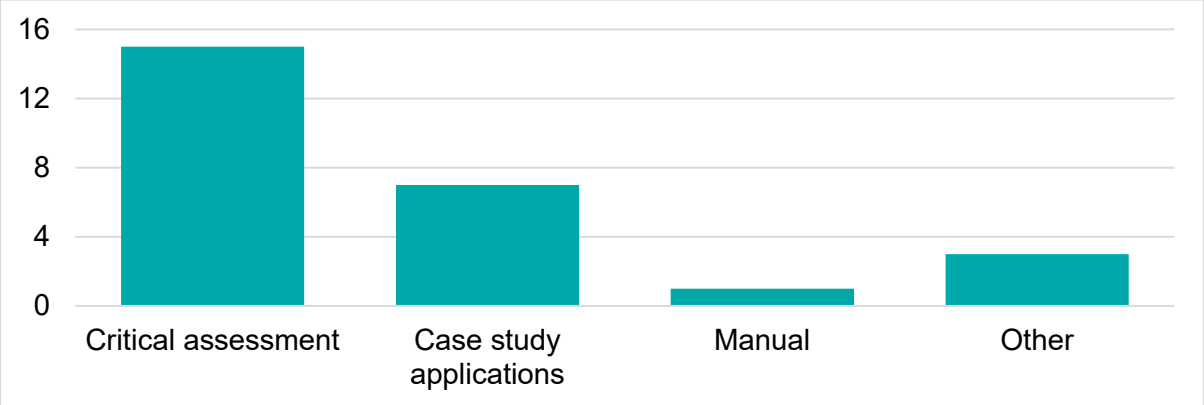
From the included papers, health impact assessments were the most common audit tool discussed (n=16). The second most common audit tool discussed was the WELL Building Standard checklist (WELL) (n=10); this includes a mix of WELL being the sole focus (n=8) and two that compared WELL with other audit tools (one with health impact assessment and other sustainability-focused tools, one with other sustainability-focused tools only). Only one paper (n=1) that fitted the eligibility criteria focused on the Built Environment Assessment Tool (Built Environment-v3_2015), while no included article (n=0) focused on the Health Facility Audit Tool.

The lack of results on the Health Facility Audit Tool is not surprising given it was intended for internal use within NSW Health only; it is also not publicised, such as via a website or as a guide. A manual Google and Google Scholar search also yielded no further results for this tool.

Study formats

The included papers most commonly provided critical assessments of one or more of the audit tools (n=15; Figure 1), with the breadth and depth of features covered, ease of use and application, cost (financial, human resources) of assessment and implementation, and barriers to adoption highlighted as the most common assessment considerations.

Figure 1: Format of included studies



Seven papers (n=7) demonstrated the applications of the audit tools via case studies. These include a mix of real-world applications (e.g. reflections on how the WELL Building Standard checklist was applied to new office buildings in Poland; Taczalska-Ryniak_2020), or via

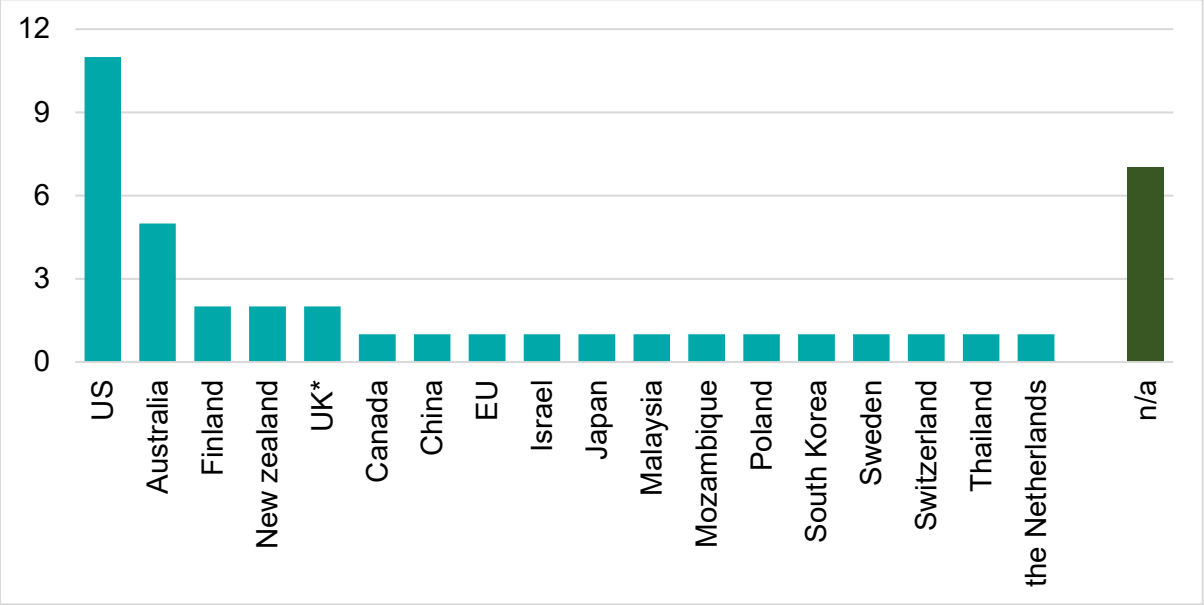
simulated experiments on how the application of such principles may impact health outcomes (e.g. Nakamura_2019). One paper is a mix of detailed methodological manual and case studies on health impact assessments (Ross_2014).

Geographic foci

The included papers represent broad geographic coverage. Most commonly the papers had a single-country focus (n=14). A notable number of papers (n=7) did not have a specific geographic focus and were instead more conceptual discussions. Five papers (n=6) reported on international comparisons: three across two countries, and three across multiple countries.

Among the included papers, the country most commonly reported on was the United States (n=11), followed by Australia (n=5; Figure 2). Finland, New Zealand and the UK were reported on in two papers each (n=2). All other countries (and one econo-political region) reported on—in alphabetical order: Canada, China, the European Union, Israel, Japan, Malaysia, Mozambique, Poland, South Korea, Sweden, Switzerland, Thailand, the Netherlands—were all reported once only (n=1); most of these were part of one multi-country comparison paper (Hebert_2012), in one book that highlighted US and international case studies (Ross_2014), or in one study that compared three countries (Negev_2012).

Figure 2: Geographic foci of included studies



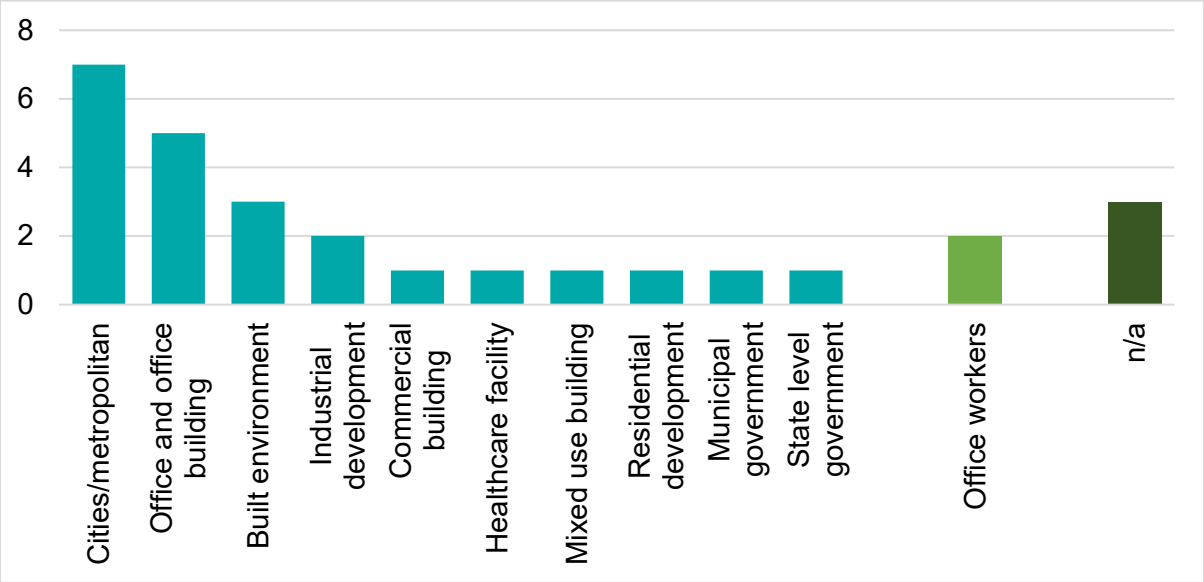
Note: * includes one case study on England only

Built environment foci

Due to the nature of the audit tools, most included papers focused on the built environment (n=22) rather than its occupants; these included reporting across different scales of the built environment (Figure 3). Only two papers (n=2) focused on occupants of these built environments (Nakamura_2019, Park_2018), both concerning office workers and/or employees.

Of all other included papers, there was a great diversity of built environment types covered, ranging from discrete places such as offices and office buildings (n=5), commercial buildings (n=1), mixed use buildings (n=1), industrial developments (n=2), and residential developments (n=1, compared to case studies on other development types). The built environment more broadly was reported in three papers (n=3), and the broader geographic scale of cities and/or urban areas were the focus of six papers (n=6), with counties and municipalities being the focus of one paper (n=1) and state-level government being the focus of another (n=1). Three papers did not specify any particular built environment focus, with one tracing the historical development of impact assessments more generally (including health impact assessments; Basson_2017), one describing and categorising the different typologies of health impact assessments (Harris-Roxas_2011), and one describing the development and conducting of health impact assessments (Ross_2014).

Figure 3: Built environment focus of included studies



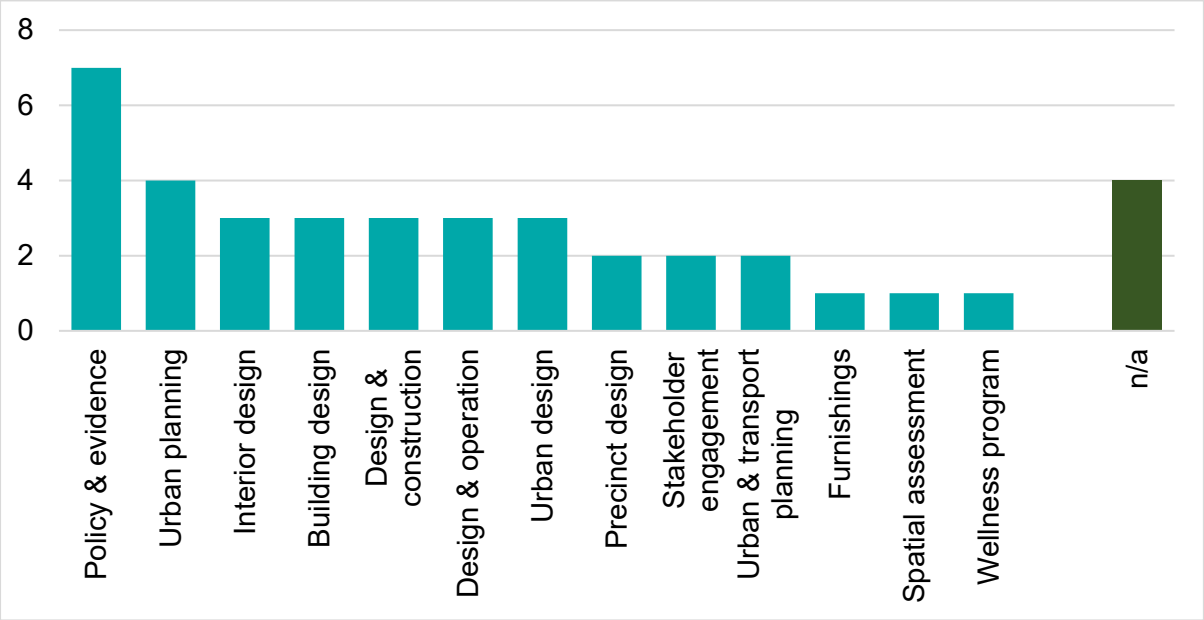
Intervention foci

Among the included papers, there is a great diversity of intervention types reported on (Figure 4). The vast majority concerned the design and implementation of hardware, with nine (six on policy design, Hebert_2012; one on wellness programs, Park_2018; two on or included stakeholder engagement, Tamburrini_2011, Ross_2014) focussing on software. This resonates with the built environment rather than occupant/user focus of these audit tools.

Of the hardware-focussed papers, the most common focus concerned urban planning issues and/or procedures (n=4), followed by the interior designs and furnishings of offices and workplaces (n=3), building design (n=3), urban design (n=3), and the design and construction (n=3) or operation (n=3) of buildings. There were two papers each on and/or included discussions on precinct design (Pineo_2018, Ross_2014), likewise on stakeholder engagement (n=2), or urban and transport planning (n=2). The retrospective spatial assessment of existing healthcare facilities was reported in one paper only (Basson_2017).

Notably, four papers (n=4) did not specify any particular intervention types, instead included more conceptual discussions of (re)designing and implementing the different audit tools.

Figure 4: Intervention focus of included studies



Overview of excluded studies

Table A1 lists the four studies excluded from this review after full-text screening, alongside the reasons for exclusion. Three studies were excluded because they only mentioned but did not focus on any of the four audit tools (Gresser_2018; Ramirez-Rubio_2019; Roskams_2019), while one was excluded because it is a non-academic, magazine article (Gonchar_2013). Despite being excluded, some of these papers may still provide useful insights that are relevant to those interested in alternative conceptual frameworks to health precinct and program designs (e.g., Roskams_2019).

Quality, risk of bias and confidence in cumulative evidence

All but two included studies were qualitative, one quantitative and one mixed-method (Table 3). Eighteen studies provided no funding statements (n=18). Remaining studies were funded via government agencies, grants and programs, as well as non-governmental foundations related to education and health (Table 2). Authors of 22 studies did not provide statements outlining potential conflicts of interests (competing interests) or lack of such conflicts. Authors of four studies provided statements declaring absence of conflicts of interests.

Rapid review limitations

Our literature search may not be fully comprehensive, and some relevant papers may have been missed. We also only included studies published in English and those published within the last 12 years.

Table 2: List and the main characteristics of the included studies

First author_Year	Title	Publication type	Audit tool	Geographic focus	Intervention target	Audit tool assessments and comparisons	Study funding; Conflict of interest
Alfonsin_2018	Active design strategies and the evolution of the WELL Building Standard™	Journal article [Q1]	WELL Building Standard (v2)	US	Office buildings; Design and operation	Focused on potentials for active design and operations strategies within and between office buildings to promote movement/ moderate to vigorous physical activities. Graded point value based on potential health impacts used to prioritise active design features.	No funding statement; No conflict of interest statement, but two co-authors worked at the International WELL Building Institute, which created the Standards
Basson_2017	Towards a conceptual framework for holistic and retrospective healthcare facility impact assessment	Conference paper	Health impact assessment	n/a	Health care facility and network; Retrospective spatial assessment	Traces the historical development of impact assessments from environmental, economic, social, through to health. HIAs borne out of EIAs, public health and	No funding statement; No conflict of interest statement

						planning decision-making approaches, thus varied forms that are difficult to compare.	
Built Environment-v3_2015	The Built Environment: An Assessment Tool and manual (An adaptation of MAPS)	Manual	BE Tool	n/a	Built environment (streets);	An objective observational assessment tool that focuses on assessing the built environment to promote physical activities as a means to health promotion. Incorporates principles set out in other guidelines and regulations on active design, crime prevention, roads and transport etc.	No funding statement; No conflict of interest statement
Danivska_2019	Environmental and social sustainability – emergence of well-being in the built environment, assessment tools and real estate market implications	Journal article [Q3]	WELL Building Standard (v1, v2); others	Australia, Finland	Commercial buildings; Design and construction	A mixed method approach to understand market factors in the adoption of, including further innovation in, well-being and sustainability certification	Finnish Work Environment Fund, Foundation for Economic Education, Rakli ry fund; No conflict of interest declared

						standards (WELL as case study).	
Forsyth_2010a	Health impact assessment in planning: Development of the design for health HIA tools	Journal article [Q1]	Health impact assessment	US	Urban (city) planning; Policy and practice	Accounting of the Design for Health tools, including updated elements of HIAs following stakeholder interviews and outcome assessments, for use by planning professionals	Blue Cross and Blue Shield of Minnesota; No conflict of interest statement
Forsyth_2010b	Health impact assessment (HIA) for planners: What tools are useful?	Journal article [Q1]	Health impact assessment	US	Urban (city) planning; Policy and practice	A critical review of the history and development of HIAs, including the need for simplification in order for adoption in the US along with EIAs which perform much of the same assessments.	No funding received; No conflict of interest declared
Harris_2010	Health impact assessment for urban and land-use planning and policy development: Lessons from practice	Journal article [Q1]	Health impact assessment	Australia	Urban and land-use planning; Policy and practice	Review of HIA case studies in relation to 4 urban determinants of health characteristics identified via literature review.	No funding statement; No conflict of interest statement

Harris_2011	Health impact assessment in Australia: A review and directions for progress	Journal article [Q1]	Health impact assessment	Australia	State/Territory governments; Policy and legislation	Traces the development and integration of HIAs, through policy, legislation or lack thereof, in each Australian State and Territory governments.	No funding statement; No conflict of interest statement
Harris-Roxas_2011	Differing forms, differing purposes: A typology of health impact assessment	Journal article [Q1]	Health impact assessment	n/a	n/a	Provides a historical overview of the development of HIAs and typologised based on purpose and current practice.	No funding statement; No conflict of interest declared
Hebert_2012	Health impact assessment: A comparison of 45 local, national, and international guidelines	Journal article [Q1]	Health impact assessment	US, UK, Finland, Netherlands, Switzerland, Australia, New Zealand, Thailand, international	Local, national and international policies and guidelines	Principles-based assessment guides that do not necessarily have set structures, though a common set of six sequential steps is often adapted. Community engagement and equity/equality considerations are highlighted as most common/important principles.	Oak Ridge Associated Universities' Oak Ridge Institute for Science and Education Program, the US Centers for Disease Control and Prevention: National Center for Environmental Health-Agency for

							Toxic Substances and Disease Registry's Graduate Environmental Health Fellowship program; No conflict of interest statement
Kang_2011	Health impact assessment in Korea	Journal article [Q1]	Health impact assessment	South Korea	Large scale industrial or infrastructure development projects	Legislated inclusion of HIA as part of EIA came into effect in South Korea in 2010, but only applicable to a very narrow (5) types of infrastructure projects. The study considers two scenarios: incorporating HIA in EIA as legislated in South Korea (status quo), or complementary HIA conducted separately.	No funding statement; No conflict of interest statement

Kantola_2020	Socially sustainable office buildings - A better business for everyone	Master thesis	WELL Building Standard	Sweden	Office buildings; Design and construction	Examined commercial drivers/factors in adopting sustainability certification, with WELL as a case study.	No funding statement; No conflict of interest statement
Koehler_2018	Building healthy community environments: A public health approach	Journal article [Q1]	Health impact assessment	n/a	Built environment/ cities; Urban design, infrastructure planning	Proposes a framework that incorporates existing public health tools (including HIAs) and approaches with considerations of built environment (urban planning, housing, green and blue spaces, public and active transit, and renewable energy).	Bloomberg American Health Initiative, US Environmental Protection Agency's Air Climate & Energy Center Grant (RD835871); No conflict of interest declared
Nakamura_2019	Effects of wellness conscious buildings on the well-being and comfort of workers	Conference paper	WELL Building Standard	Japan	Office workers; Interior designs and furnishing	Field-tested the WELL Building Standards (interior and furnishing) on environmental satisfaction, subjective health, and subjective	No funding statement; No conflict of interest statement

						work capacity via 4 scenarios.	
Negev_2012	Integration of health and environment through health impact assessment: Cases from three continents	Journal article [Q1]	Health impact assessment	England; US; Israel	Cities/metropolitan; Policy, planning and decision-making	Describes health professionals' participation in 3 EIA case studies, changes to inter-institutional procedures and cooperation, and solutions to environmental and health outcomes.	Environment and Health Fund doctoral scholarship (first author); No conflict of interest statement
Nieuwenhuijsen_2017	Participatory quantitative health impact assessment of urban and transport planning in cities: A review and research needs	Journal article [Q1]	Health impact assessment	n/a	Cities/metropolitan; Urban and transport planning	HIAs typically undertaken via qualitative approaches to inform policy/ program decision-making, with few quantitative elements embedded to track/estimate potential, longer-term outcomes. The study also considers the value of full-chain exposure assessment for short- and longer-term impacts monitoring.	No funding statement; No conflict of interest statement

Northbridge_2003	A joint urban planning and public health framework: Contributions to health impact assessment	Journal article [Q1]	Health impact assessment	n/a	Urban/metropolitan ; Urban planning	Considered the value of joint planning and public health perspectives in informing the design, implementation and monitoring of HIAs.	US Centers for Disease Control and Prevention's Harlem Health Promotion Center, the Robin Hood Foundation's Harlem Children's Zone Asthma Initiative, Volve Research and Education Foundations; No conflict of interest statement
Park_2018	Facilitating the WELL Building Standard through wellness programs in the workplace	Conference paper	WELL Building Standard	US	Employees; customising wellness programs to complement WELL assessments	The study explored overlaps between the WELL Building Standards and US guidelines on office wellness programs, where some goal overlaps were apparent. It proposes similar overlap scenario	No funding statement; No conflict of interest statement

						studies be conducted with other Standards as well as economic feasibility and implementation analyses.	
Pineo_2018	Cities, health and well-being	Report	Health impact assessment ; WELL; others	n/a	Built environments; Building and precinct designs	HIAs can involve a mix of quantitative, qualitative and participatory approaches to assess health as well as equity. Not only built environment-specific. WELL includes different modules specific to interiors, exteriors, new and existing buildings. Scope also broader than BREEAM and LEED. Both HIA and WELL are temporally-specific, and may require regular/ repeat	UK Royal Institution of Chartered Surveyors; No conflict of interest statement

						professional assessment/ certification.	
Ross_2014	Health impact assessment in the United States	Book	Health impact assessment	US	Cities, metropolitan and urban planning; Design, construction and operation, stakeholder engagement	A detailed description of the development and application of HIAs within urban and community planning. Includes discussions on how HIAs may be expanded (e.g. use of emerging technologies) to further applications.	No funding statement; No conflict of interest statement
Shively Slotterback_2011	Testing three health impact assessment tools in planning: A process evaluation	Journal article [Q1]	Health impact assessment	US	Counties and municipalities; Urban design and planning	HIAs are flexible and may encompass a diversity of methods and techniques, as opposed to the related EIAs which are highly structured. Effective participatory nature can effect behavioural change prior to intervention.	Blue Cross and Blue Shield of Minnesota; No conflict of interest statement
Suarez Flores_2017	Contributing with voluntary	Master thesis	WELL Building	US	Commercial office buildings; Building	Conducted a survey with	No funding statement;

	certification systems: A case-study evaluating knowledge gaps between design professionals and the Well Building Standard		Standard (v1)		and interior designs	design professionals on the practice-gap in voluntary certification system code implementation, using WELL as a case study.	No conflict of interest statement
Taczalska-Ryniak_2020	Healthy office by WELL Building Standard: Polish examples	Conference paper	WELL Building Standard	Poland	Office buildings; Interior design	Case study explanations of recent Polish office applications of the WELL Building Standard.	No funding statement; No conflict of interest statement
Tamburrini_2011	Enhancing benefits in health impact assessment through stakeholder consultation	Journal article [Q1]	Health impact assessment	US; Australia	Industrial and residential neighbourhoods; stakeholder engagements	Examined the modes and means of stakeholder engagement in HIAs across 3 case studies, and assessed the related outcomes.	No funding statement; No conflict of interest statement
Tan_2022	Streamlining WELL concepts of office buildings for developing countries:	Conference paper	WELL Building Standard (v2)	Malaysia	High-rise office buildings	The WELL Building Standards v2 was applied and extended to include 3 additional features that	Universiti Malaysia Pahang [PDU213001-1];

	The case of Malaysia					associate with the developing country context of Malaysia. Policy, regulatory, capacity and financial barriers to implementation identified.	No conflict of interest statement
Xie_2020	From green to healthy buildings: A comparative study of the USA and China	Book chapter	WELL Building Standard	China; US	Residential and office buildings; Design and operation	Compared the coverage of the WELL Building Standards and China's Assessment Standard for Healthy Buildings in terms of approach and outcomes foci.	No funding statement; No conflict of interest statement

Table 3: Summary of conclusions of the included studies

First author_Year	Approach and methodology	Study conclusions
Alfonsin_2018	Qualitative; Review and commentary	v2 updated optimisation feature scoring to graded values based on potential health impacts, therefore centralises health impacts in design considerations and operation strategies. The prioritising of active designs aligns with the public health agenda on “Move More/Sit Less” to counter sedentary time in the office.
Basson_2017	Qualitative; Review and commentary	HIAs currently take many forms and approaches, and therefore are difficult to compare. Recommends the development of a flexible structure that algins with regional/ national level healthcare efficacy measures, and take into account of emerging international guidelines including the Sustainable Development Goals.
Built Environment-v3_2015	n/a; Instruction manual	Describes in detail the direct systematic observation data collection instrument for health-promoting built environments. Provides comprehensive instructions and checklists for the assessments.
Danivska_2019	Qualitative; Desktop review of audit tools and certification schemes (n=14) and semi-structured interviews with real estate and sustainability consultants (n=7)	Market for well-being certification scheme continues to grow, with more recent versions placing more emphasis on personal and social characteristics than just energy and sustainability characteristics. Mainly ‘hard’ building features are comparable across different current audit tools. Human/occupier perspectives only included in newer, wellbeing-oriented tools. Stakeholder interviews reveal complexity and cost of certification remain prohibitive. Competitiveness in the international market for commercial offices appears to influence pace of certification adoption.
Forsyth_2010a	Qualitative; Stakeholder interviews and evidence review (n=n/a)	A new set of HIA-inspired tools developed following academic calls for greater transparency in tool development and reviews. The new suite offers greater structure but remains time- and skill-/ resource-dependent, both of which may be prohibitive to further adoption/development.
Forsyth_2010b	Qualitative; Review and commentary	HIAs may be a systematic tool that planners can exercise to gauge and evaluate the health impacts of plans, policies and development proposals. Their complexities, and continued view of health as additional responsibilities to planning, remain major barriers.

Harris_2010	Qualitative; Case study (n=13) and literature reviews	HIAs can provide valuable evidence to inform policy developments, but outcomes are dependent on practice capacity (workforce, health system) to operationalise practice.
Harris_2011	Qualitative; Federal and State/Territory-level policy and legislation review (n=9)	Development of HIAs across Australian jurisdictions shows growing interest in health considerations in policy development. Concerns around further complicated legislated EIA processes, costs, capacity, and demonstrable impacts.
Harris-Roxas_2011	Qualitative; Critical review of HIA or related guidelines (n=n/a)	HIAs can be broadly categorised into 4 types (mandated, decision-support, advocacy, community-led), each of which serves different purposes. This offers flexibility and responsiveness to needs of HIA, but approach taken may also lead to divergent outcomes. Diverse typologies customisable to specific project/policy being assessed. Difficult to compare, and outcomes may depend on approach undertaken. Can be a good, comprehensive assessment pre-project/policy implementation to facilitate adjustments.
Hebert_2012	Qualitative; critical review of national/ cross-national HIA guidelines (n=45)	The study considers the merit and drawbacks of universal guidelines for HIAs, and concludes that while standardisation can ease access and application, it may not have the necessary flexibility to reflect the specificities of the projects, policies and/or programs being assessed.
Kang_2011	Qualitative; Scenario testing (n=2)	The study concludes that the current legislated model only considers limited physical/ environmental determinants of health (e.g. pollution), but the complementary approach would expand the scope, build sectoral capacity, and raise public awareness.
Kantola_2020	Qualitative; semi- and structured interviews with companies familiar with the WELL certification/ registration process (n=6)	The study concludes that WELL appears more user-friendly than other comparable sustainability and/or wellbeing built environment standards. The lack of mandate via legislation is noted as a barrier, with further adoption reliant on proponent goodwill, innovation and/or incentives. WELL more accepted by owners and developers for strategic reasons, immediacy and personal aspect of benefits compared to environmental sustainability certification. Also fills a knowledge/expertise gap by expanding areas of consideration.
Koehler_2018	Qualitative; Document and literature review (n=n/a)	HIAs can be adapted to move beyond risk assessment and mitigation to hazard prevention and health promotion. Advocates

		for cross-disciplinary and systematic approaches. Approach to public health practice, research and education needs to change to further promote HIA as a useful, collaborative tool that aids decision-making. A shift for HIAs to a more quantitative approach is also needed to demonstrate health and economic costs and benefits in longer term.
Nakamura_2019	Quantitative; Experimental scenarios (n=4), post-occupancy survey (n=14)	The study shows that compliance with WELL Building Standards can statistically significant improvements in environmental satisfaction, subjective health of workers, and subjective work capacity in scenarios that followed WELL's physical and furniture standards.
Negev_2012	Qualitative; Case study comparisons (n=3)	HIAs facilitated inter-institutional and inter-sectoral discussions and knowledge exchanges, including leading to changes in impact assessment procedures and scopes. Conflicts and obstacles across institutions and sectors remain, limiting opportunities and degrees of synergy.
Nieuwenhuijsen_2017	Qualitative; Rapid review of quantitative HIA applications on urban and transport planning (n=n/a)	Quantitative elements should be considered to broaden the scope—of assessment, monitoring and impact-tracking—of HIAs. Full-chain exposure assessment would better inform decision-making throughout the life of the project/policy/program, from design through implementation to monitoring.
Northbridge_2003	Qualitative; Commentary	The need for joint urban planning and public health considerations in planning healthy cities, including mechanisms that ensure equality, democracy and meaningful participations and contributions. There is a greater need for cross-disciplinary collaborations and linkages to devise effective policies for health-promoting built environments. Tools like HIA can facilitate in bridging the gaps but must be co-developed to extend effectiveness.
Park_2018	Qualitative; scenario testing (n=6)	There are crossovers and alignments between wellness program guidelines and WELL Building Standards, but approach to achieving outcomes differ, ranging from directive (e.g. smoking bans) to peer motivation. Additional WELL features can, and should, be incorporated into guidelines to further enhance worker wellness programs.
Pineo_2018	Qualitative; Assessment standards comparisons (n=4)	The study compares the sustainability and healthy building standards features of WELL, BREEAM and LEED and HIA approaches. It requires cross-sectoral collaborations, with focus broadened to include values other than just financial return on investments.

Ross_2014	Qualitative; Review and commentary, case studies (n=27)	HIAs have the potential of being prospective rather than just measure point-in-time, but its efficacy remains limited or misunderstood with evidence on value and outcome often less or not demonstrable. Proposes incorporating other health assessment mechanisms to broaden the breadth and potential of HIAs.
Shively Slotterback_2011	Qualitative; Case studies (n=19)	HIA is a good but should not be the only source of information that aid decision-making. It may have the added co-benefit of engagement and education. Successful implementation of outcomes may require a champion proponent.
Suarez Flores_2017	Mixed methods; Mixed method questionnaire survey with design professionals (n=90)	The study concludes that WELL reflects growing practitioner focus and consideration of wellness within the design field. WELL has built-in mechanisms that promote innovation and tool improvements that may not be fully realised through the voluntary nature of certification system. May be overcome with additional instructions and incentives. Greater clarity on outcomes pathways would also assist their further adoption.
Taczalska-Ryniak_2020	Qualitative; Case studies (n=2)	Reflections on how the WELL Building Standards were put into recent practice in Poland. Notable qualitative improvements to office workers' wellbeing and work environments.
Tamburrini_2011	Qualitative; Review and commentary	HIAs have built in mechanisms for meaningful stakeholder engagements that can lead to demonstrated benefits (improved cross-sectoral relations, more ready acceptance of recommendations, community empowerment). Focus remains on mitigating negative rather than enhancing positive impacts.
Tan_2022	Qualitative; Semi-structured interviews with high-rise office workers (n=23)	The study reveals workers' concepts of healthy offices align with those proffered in the WELL Building Standards, with three additional, context-specific concepts proposed to further WELL's considerations.
Xie_2020	Qualitative; Assessment standards comparisons (n=2)	The WELL Standards have broader considerations than other assessment standards, developed based on medical theory and research, and has closer links to on-going health-focused performance metrics than other overall measures. China's Assessment Standard for Healthy Buildings was developed under a different cultural and policy context, and has more emphasis on the post-operation phase.

Discussion

The purpose of this rapid review was to draw on secondary literature that focussed on four specific built environment audit tools to gather evidence on their critical assessments and/or applications of these tools for designing built environments that safeguard as well as promote health. The ultimate aim of this rapid review was to reflect on such evidence and assess the suitability of these tools for application at the health precinct scale.

The four audit tools received contrasting levels of academic and grey literature attention. Despite most being of similar age—created and issued within the past decade, with the exception of health impact assessment—the Australian and international applications of these tools were vastly different.

Little evidence for the NSW Health's Health Facility Audit Tool was found, whether via the systematic or manual searches, owing largely to its internal use intention and purpose. Of the other three, the longer-established health impact assessment was the most commonly reported on, ahead of the WELL Building Standard. The only paper included on the Built Environment Assessment Tool (BE Tool) by the US Centers for Chronic Disease Prevention and Health Promotion was that of its instruction manual. Little evidence was also found via manual searches, suggesting the more limited application of the BE Tool.

Approaches to assessments and auditing

The WELL Building Standard checklist and health impact assessment proffered contrasting approaches to assessments and auditing.

The WELL Building Standard checklist was more commonly highlighted for its broad coverage and ease of use. Its standardised list of items reflects a structured approach to assessment. Its updated versions also signify a continued shift towards social sustainability and well-being and less on built-form operations. The cost (both financial and human resource) associated with certification was brought up as a potential barrier in several articles (Danivska_2019, Kantola_2020, Pineo_2018). The checklists—with separate versions customised to focus on interiors, exteriors and furnishings—remain focused on individual buildings (or a smaller scale within, such as individual offices inside buildings; e.g. Nakamura_2019, Taczalska-Ryniak_2020) and may not be easily adopted to other scales such as health precincts.

A common critique of checklist-based audit tools like that of WELL resonates with existing literature (e.g. Berke & Vernez-Moudon 2014; Boarnet et al. 2008; Jones et al. 2020), concerning their common focus on the presence and absence of features. While such focus affords relatively simple applications, the depth and extent of any impacts (whether positive or negative) is difficult to gauge. This difficulty in measuring and demonstrating anticipated benefits makes it harder to convince policymakers, developers and other stakeholders of the value of the interventions, potentially limiting broader applications (Jones et al. 2020).

In contrast, health impact assessment is commonly noted as being guided by principles rather than specific structures and, therefore, can be flexibly adapted to suit specific purposes (e.g. Harris-Roxas_2011, Ross_2014). This allows non-built-form features—such as policy impacts—to be more easily and readily included and assessed compared to standardised checklists like WELL. This unstructured flexibility, however, is also noted as a drawback, especially the complexity concerning cross-study comparisons, where each health impact assessment is specifically designed and, therefore, may not incorporate

comparable or similar methods. This is particularly due to the largely qualitative nature of health impact assessments, often involving few quantitative elements, which also limits it potential for longer-term outcome monitoring (e.g. Nieuwenhuijsen_2017). Its principle-based approach, however, can be more easily adopted for broader-level assessment beyond individual buildings (e.g. Hebert_2012, Koehler_2018, Nieuwenhuijsen_2017, Northbridge_2003, Pineo_2018, Ross_2014, Shively Slotterback_2011).

Further drawbacks

Concerning audit tools more generally, the absence of—or difficulty in—quantifying anticipated benefits are noted to have two important drawbacks:

1. The impacts and outcomes are not necessarily, or easily, linked to national or international benchmarks and/or minimum standards (such as those concerning air quality or accessibility), so that even in cases where improvements are demonstrable, knowledge exchanges—whether within regions or internationally, or within and across sectors—are difficult and not easily facilitated.
2. Assessments and audits are largely point-in-time, with some impacts immediate while others emerging progressively over time. Time-series tracking is, therefore, needed to reflect the full extents of anticipated impacts. Tracking and monitoring of progress, however, often require re-assessments and re-certification, which add additional financial and human resource costs that may be prohibitive (Pineo_2018, Ross_2014).

Conclusions

The evidence highlighted in this rapid review shows that there have been notable developments in built environment assessments and audits in the past decade. The newer tools—Health Facility Audit Tool, the WELL Building Standard checklist, and the BE Tool, as included in this review—have largely departed from the qualitative approach of the long-established health impact assessment to be more itemised checklist-oriented. While notably easier to apply and implement, these checklists have been noted as more suitable to individual buildings (or specific features within buildings) than the more flexible applicability of health impact assessments.

The shift to more readily highlight the social aspects of buildings in the recent updates to WELL is a notable recognition of the need to move beyond just the design and operations of buildings but also how and by whom these buildings are used. The scope must also be expanded to include other less tangible aspects of how buildings are used. This is especially true when the design and operations of buildings are more likely to be influenced and shaped by legislations (such as those on hazard reductions and minimum standards) while the day-to-day use of these spaces remain largely unguided.

Further, with “more than the sum of its parts” (Rampuria et al. 2022) acknowledged, these more recent audit tools also require further development for them to be applicable beyond the building scale, such as at health precincts. The list of case studies—predominantly individual office spaces or buildings—highlighted in the included papers are further testament to the limitations of application of these audit tools.

Last but not least, and resonating existing literature, there is an obvious disjuncture between these audit tools and national and international health and environmental standards such as those concerning air quality, light and noise pollution, and accessibility. This makes the measuring and monitoring of anticipated benefits, both immediate and longer-term, difficult in the absence of regular reassessments, which, as several papers highlighted, are cost prohibitive and limiting their user-friendliness.

Going forward

Taking heed to Ross et al. that “the ability to utilize the output of other health assessments as inputs into the HIA process is a strategy worthy of consideration” (Ross_2014: 186), it is likely beneficial to develop an amalgam audit tool with health precincts in mind, one that incorporates the ease-of-use of checklists, linked in with national and/or international benchmarks, as well as principle-based qualitative elements that can more easily account for the more socially-oriented and less tangible user experiences and outcomes of these spaces.

With emerging technologies in mind, many of the quantitative elements may be automated to facilitate regular and on-going monitoring. Different qualitative elements updated in turn on a semi-regular basis, so that a full qualitative assessment may only be conducted every few years (akin to the five- or ten-yearly census cycles undertaken by many government statistical bureaus worldwide) after an initial full assessment. Such an approach may circumvent the intense financial and human resourcing that is noted to be potentially prohibitive while facilitating recurrent updates.

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Appendices

Figure A1: PRISMA diagram of literature searches and selection

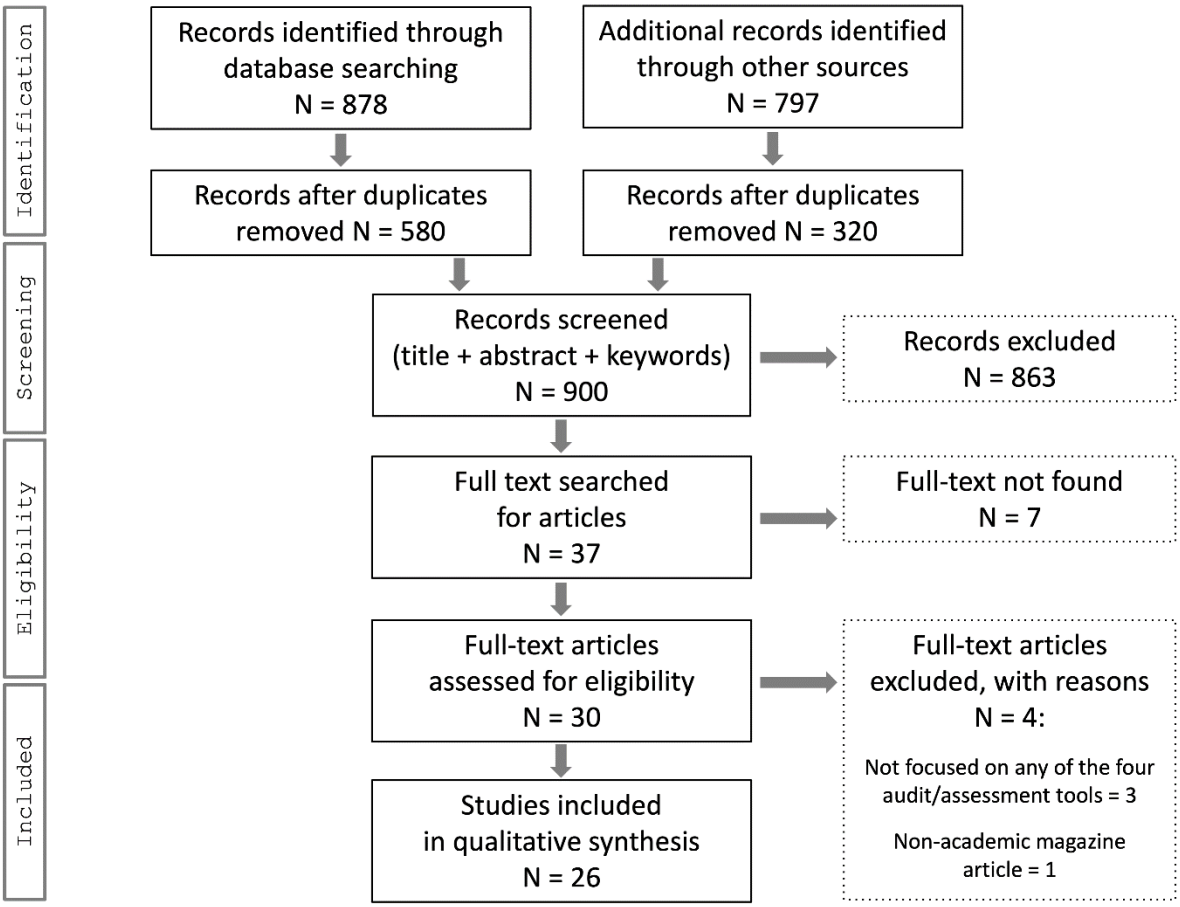

Table A1: Table of excluded studies at the full-text screening stage, with reasons.

First author_year	Reference	PDF available	Reason for exclusion
Gonchar_2013	Continuing Education: Well Building Standard	Yes	Non-academic magazine article
Gresser_2018	Sustainable Cities and Communities Design Handbook: Green Engineering, Architecture, and Technology	Yes	Not focused on any of the four audit/ assessment tools
Ramirez-Rubio_2019	Urban health: an example of a “health in all policies” approach in the context of SDGs implementation	Yes	Not focused on any of the four audit/ assessment tools
Roskams_2019	Salutogenic workplace design: A conceptual framework for supporting sense of coherence through environmental resources	Yes	Not focused on any of the four audit/ assessment tools