

Learning Health Systems

Organizational LHS Future Vision Perspective

CDO CQI teams have ready access to—and efficiently leverage—tools and resources that help them engage local stakeholders and take other steps needed to continuously improve care delivery processes and outcomes⁴¹. These tools and resources are informed by best evidence and practices, address costs, are sensitive to local needs, and support target-focused QI efforts as well as broader organizational care transformation/LHS initiatives. For example, a new generation of care transformation support toolkit (analogous to “Care Plan Support Tool”) helps QI teams access and apply tools pertinent to their particular CQI needs. This toolkit makes it easier to identify, select, access, and use QI tools from AHRQ and others (e.g., such as those samples in Table B-7. Current AHRQ (& Other) Resources for LHSs in the more detailed the Organizational LHS Ideal Future Vision.

These tools and resources are applied in a context where CQI goals and processes are an organizational mission priority, led and supported by executives and clinical champions and embedded in an interprofessional learning culture that nurtures workforce and talent development, fosters joy and meaning in practice, and achieves an LHS. Organizational and regulatory requirements are harmonized to support optimal care, reduce administrative burden, and drive progress toward the Quintuple Aim.

The Organizational LHS Ideal Future Vision is further described in Detailed LHS Perspective of the ACTS Future Vision.

National LHS Future Vision Perspective

The national LHS will fully “harness the power of data and analytics to learn from every patient and feed the knowledge of ‘what works best’ back to clinicians, public health professionals, patients, and other stakeholders to create cycles of continuous improvement.” (282) Measurable improvements in the Quintuple Aim are achieved through widespread implementation of LHS **organizations** that:

- Have leaders who are committed to a culture of continuous learning and improvement (283)
- Systematically gather and apply evidence in real-time to guide care
- Employ IT to share new evidence with clinicians to improve decision making (i.e., as outlined in the 3. Care Delivery Perspective of the ACTS Future Vision)
- Promote the inclusion of patients as vital members of the learning team
- Capture and analyze data and care experiences to improve care
- Continually assess outcomes, refine processes, and conduct training to create a feedback cycle for learning and improvement

This future is facilitated and propelled by leadership and collaboration at a **national scale** that works to facilitate and ensure the conditions that allow LHSs to emerge and thrive. These stakeholders reduce organizational and professional burden by harmonizing expectations and incentives to optimize continuous learning and improvement across diverse healthcare settings. They bring together diverse stakeholders to align and optimize data and technology approaches that fuel LHS insights locally and as part of a national community of practice. The culture of healthcare improvement shifts toward meaning and joy buoyed by data-informed continuous learning.

The flow of information, tools, and resources around the LHS cycle creates a virtuous cycle that continuously improves processes and results and achieves the Quintuple Aim. Payment drivers and policies support this and foster full realization of the other future vision perspectives. In an ideal future state, **national** approaches will include:

- Harmonization of organizational and professional regulatory requirements for CQI, performance management, use of targeted real-time data, and continuous learning to reduce administrative burden and drive progress toward the Quintuple Aim
- Policy, collaboration, and funding approaches to spur elaboration, endorsement, and implementation of LHS key principles (e.g., LHS Core Values (284), LHS competencies for researchers (285)) that make possible an interconnected community of practice
- Evolution of accountability frameworks, measures, and payment approaches from individuals toward accountable teams and systems (190) (286) (287)
- Engagement with organizations and stakeholders that lead and inform continuous organizational and workforce learning (e.g., workforce development, performance management, accredited continuing education, teaming, talent development)
- Other supports that enable fully realizing the future visions outlined for the other three future perspectives

The National LHS Ideal Future Vision is further described in Detailed LHS Perspective of the ACTS Future Vision.

For a future vision for digital knowledge ecosystem supported by offerings from AHRQ and others; see what a digital knowledge ecosystem will enhance (link).

Detailed LHS Perspective of the ACTS Future Vision

Introduction and Purpose

This section outlines the fundamental role that continuous learning plays in healthcare improvement. The future vision perspective described here, where continuous learning is an essential catalyst for achieving the Quintuple Aim (22), requires two frames of reference—a national LHS scale and an organizational LHS scale (i.e., CDO). This section describes the current state and envisioned future state from each of these perspectives. The authors have included this dichotomy together to recognize the active and interdependent relationships of data, knowledge, and practice within and between healthcare organizations that fuel continuous learning and improvement for all.

AHRQ defines an LHS as, “a health system in which internal data and experience are systematically integrated with external evidence, and that knowledge is put into practice.” (283) As a result, patients get higher quality, safer, more efficient care, and healthcare delivery organizations become better places to work.” The idea was first conceptualized in a 2006 workshop (288) organized by the U.S. IOM, and progressively developed through several convenings, publications, and ongoing initiatives.^[2] In 2011, the IOM’s (now the National Academy of Medicine) Digital Learning Collaborative described a shared value framework for both the national and organizational LHS perspective in which, “progress in science, informatics, and care culture align to generate new knowledge as an ongoing, natural by-product of the care experience, and seamlessly refine and deliver best practices for continuous improvement in health and healthcare.” (289)

In this vision, organizations—as LHSs—embody a “cyber-social system of people and technology” (290) that supports iterative learning cycles that turn data into knowledge that informs practice and generates data from practice that creates new knowledge, and so on. In this publication, Charles Friedman et al. explain that, “Learning cycles can occur at varying levels of scale. They can be undertaken by a single organization, by networks of otherwise independent organizations, by specialized disciplines that span organizational, legal, and geographic boundaries, and across geographical regions varying in size, from counties to states/provinces to entire nations. Because the actions necessary to execute learning cycles are, to a significant degree of approximation, invariant across these levels of scale, LHSs exhibit important fractal-like properties of self-similarity. The infrastructure supporting LHSs is capable of delivering the same services at any level of scale.” Therefore, at a national scale, a community of many LHSs create opportunities to harness the large-scale creation and utilization of data to and from practice to support continuous learning and healthcare improvement within and across CDOs.

With this described framework, LHS approaches encompass activities which may be labeled “care transformation.” These include (e.g., redesigning care delivery processes broadly to achieve outcomes more aligned with the Quintuple Aim^[3] (23)), Redesigning care processes may be target-focused QI (e.g., redesigning care processes to improve a particular performance measure over a focused time period), or CQI where targeted improvement efforts are managed as an ongoing rather than time-limited initiatives.

However, the LHS methodology is to advance the efficiency and sustainability of continuous improvement by building systematic capability for learning, itself. The LHS future, then, is a catalyst for bringing the Roadmap’s Care Delivery Perspective of the ACTS Future Vision (improving the efficiency, efficacy, and experience of care team work) and the Resource Developers’ Perspective of the ACTS Future Vision (advancing the utility of data and data systems to improve care) to fruition in a local and national context. Through LHS approaches, organizations identify, customize, and optimize improvement tools and processes that meet their unique needs. In the context of their own environments, learning activities produce data and are informed by that data, and they are collaboratively studied and honed (at different scales) so that they can become more effective and efficient in promoting change. When LHSs operate at a national system scale, their data, insights, and methods accelerate the community’s learning which, in turn, elevates learning at the organizations. These fruits not only include optimization of improvement-related tools and resources, but engagement of the healthcare workforce in collaborative leadership (for improvement) that builds meaning.

Organizational LHS Perspective Current State

Although CDOs and the healthcare workforce is widely engaged in some manner of QI (i.e., CQI) efforts, only a small number of healthcare organizations are pursuing LHS approaches (i.e., leadership-led culture of learning, producing/consuming data to/from practice to inform CQI, embedded expertise to support continuous learning).

Precisely because CDOs and support organizations are pursuing so many different approaches for care transformation, most are unable to allocate time and resources to take a reflective and data-informed organization-wide approach to learning from their own care delivery performance. They are surrounded by data from practice and outcomes of care but lack the means to derive meaning from that data that can inform continuous improvement. The result is preventable harm and an inability to address care quality in a substantive way.

Healthcare policy, payment, and accountability approaches do not favor collaborative, interprofessional learning and improvement at an organization, practice, and team level.

As described in the Roadmap report, the journey toward value-based care currently includes a number of obstacles to interprofessional collaborative practice, let alone interprofessional practice-based learning. Within CDOs, efforts to support documentation for billing and reimbursement take time and resources away from patients, but prevent the broader healthcare workforce from Workforce burnout—defined as, “a syndrome characterized by emotional exhaustion that results in depersonalization and decreased personal accomplishment at work”—is an increasingly recognized problem resulting from the complex demands on clinicians.

The environment of myriad regulatory and professional expectations for organizations and clinicians/care teams, respectively, to participate in CQI (including clinical performance improvement) is a major driver of clinician burnout. (291)

"The emotionally exhausted clinician is overwhelmed by work to the point of feeling fatigued, unable to face the demands of the job, and unable to engage with others." Aside from the deleterious effect burnout has on health professionals, it has been shown to adversely affect the quality of care and patient safety (292). The abundance and complexity of quality- and performance-related expectations has also resulted in a significant (if unintended) quagmire of administrative burdens that CDOs and their workforce must bear (e.g., organizational requirements from CMS and the Joint Commission, professional requirements such as Continuing Board Certification, aka MOC). Further, the lack of meaningful clinician engagement and leadership in CQI processes is an identified factor (283) that places the Quintuple Aim out of reach in the current state.

Improvement tools and resources are underused because there is little or absent infrastructure (i.e., time, people, resources) that can make them usable and effective to address the local "real life" contexts of individual CDOs.

A growing number of tools, resources, and platforms have been advanced by AHRQ and others (see Table B-7. Current AHRQ (& Other) Resources for LHSs) to support LHS values (i.e., CQI and care transformation) via national, organizational, and team/individual approaches. These resources range from broad, capacity-building workforce development curricula (e.g., TeamSteps (293)) to embedded practice-based products (CAHPS® Clinician & Group Survey (294)) to data-sharing frameworks to support clinical decision making (CDS Connect (98)). These programs include collaborative approaches for convening, funding, and fostering limited communities-of-practice for organizations and individuals utilizing these tools.

To make use of this catalog of different tools and resources, individual CDOs must:

- **Navigate** multiple, variegated sources for tools and resources
- Possess staff time/expertise to **identify** those resources that meet their needs (broadly stated)
- Be able to **customize** those tools/resources to their setting and specific needs
- Have resources to **lead** or **coach** others on resource/tool implementation
- **Measure/reflect** on the impact that the tool/resource is having on clinical performance/care outcomes in order to identify opportunities for improvement

Considering these steps within a single organization, let alone across multiple organizations, it is apparent that the resources currently required to identify, customize, and manage the implementation of multiple CQI/care transformation tools are significant, if not out of reach. Putatively, this may contribute to poor or variable utilization of these tools across CDOs.

LHS leaders, core values, and an incipient community of practice (291) provide an encouraging vision of the future but are insufficiently distributed and supported to lead substantive change for the larger healthcare system.

LHS visionaries and practitioners have been working together for more than 10 years to create a framework for LHS implementation. In recent years, these efforts have yielded LHS researcher core competencies (295), core values (296), collaborative implementation initiatives (e.g., LHS Centers of Excellence (297)), and case studies (298). The University of Michigan oversees an open-source *Learning Health Systems* journal (299), edited by Dr. Charles Friedman, who helped explore the concept of LHSs in 2010 through IOM while at the ONC. International efforts in support of LHS implementation include the Learning Healthcare Project (UK) (300) and the Swiss LHS (301).

U.S. efforts have laid the groundwork for domestic LHS implementation, but the national and local organizational resources required for broad implementation are not yet in place. The current state observations in this appendix are, collectively, the evidence of the obstacles that separate LHS aspirations from widespread implementation.

Organizational LHS Ideal Future Vision

In an ideal future state, CDOs and their partners will endorse and implement LHS core values (284). Design and operation of LHSs are derived from the following core values (296):

1. **Person-Focused:** The LHS will protect and improve the health of individuals by informing choices about health and healthcare. The LHS will do this by enabling strategies that engage individuals, families, groups, communities, and the general population, as well as the U.S. healthcare system as a whole.
2. **Privacy:** The LHS will protect the privacy, confidentiality, and security of all data to enable responsible sharing of data, information, and knowledge, as well as to build trust among all stakeholders.
3. **Inclusiveness:** Every individual and organization committed to improving the health of individuals, communities, and diverse populations, who abides by the governance of the LHS, is invited and encouraged to participate.
4. **Transparency:** With a commitment to integrity, all aspects of LHS operations will be open and transparent to safeguard and deepen the trust of all stakeholders in the system, as well as to foster accountability.
5. **Accessibility:** All should benefit from the public good derived from the LHS. Therefore, the LHS should be available and should deliver value to all, while encouraging and incentivizing broad and sustained participation.
6. **Adaptability:** The LHS will be designed to enable iterative, rapid adaptation and incremental evolution to meet current and future needs of stakeholders.
7. **Governance:** The LHS will have that governance which is necessary to support its sustainable operation, to set required standards, to build and maintain trust on the part of all stakeholders, and to stimulate ongoing innovation.
8. **Cooperative and Participatory Leadership:** The leadership of the LHS will be a multistakeholder collaboration across the public and private sectors including patients, consumers, caregivers, and families, in addition to other stakeholders. Diverse communities and populations will be represented. Bold leadership and strong user participation are essential keys to unlocking the potential of the LHS.

9. **Scientific Integrity:** The LHS and its participants will share a commitment to the most rigorous application of science to ensure the validity and credibility of findings, and the open sharing and integration of new knowledge in a timely and responsible manner.
10. **Value:** The LHS will support learning activities that can serve to optimize both the quality and affordability of healthcare. The LHS will be efficient and seek to minimize financial, logistical, and other burdens associated with participation.

CDOs will use an LHS to implement a leadership-instilled learning culture.

With an institution-wide learning culture that is led from the top, CQI will be synonymous with institutional mission-priorities and harmonized with workforce development, performance management, and a caring approach to patients and communities.

The ranks of improvement personnel will be expanded to include all organizational stakeholders, from the healthcare workforce to patients with lived experience, families, and community-based public representatives.

The learning culture will value and engage clinicians and interprofessional teams in collaborative leadership of continuous learning and improvement that fosters joy and meaning in practice.

CDOs will invest in human capital (e.g., learning/change-management professionals, researchers) that lead and facilitate continuous learning and improvement.

To address the gaps of translating knowledge to practice and producing knowledge from practice, organizations will dedicate resources to build organizational competency for continuous learning and change management. These approaches will include:

- Recruitment, training, and professional development of learning professionals who can work collaboratively and interprofessionally to identify /select, inform, and coach individuals, teams and systems on the use and customization of LHS implementation resources (e.g., care transformation support tools) in the context of workforce development, talent development, and performance management
- IT personnel to lead/support access to, and optimization of, LHS implementation resources
- Researchers who help their organization reflect on its own performance/improvement and create knowledge from practice that can be shared with other LHSs

CDOs will achieve real-time and near real-time data collection and analysis that informs continuous learning and improvement.

LHSs use health IT tools and resources as both producers and consumers of local (and collected national) data from practice that informs learning and improvement in practice. These approaches include:

- Benchmarking using a variety of data sources (own system, other like systems, regional, U.S., commercial, and CMS claims)
- Information is easy to see and digest to allow rapid pivots in LHS learning cycles, and modification to data collection elements accommodates rapid pivots
- Data collection and analysis methods result in decreased workforce burden and an increase in targeted, actionable, patient-centered improvements

The LHS will have care transformation support tools that provide the means to leverage national and local/institutional LHS knowledge to achieve practice-based improvement that is both informed by evidence and customized to local settings.

At the institution level, access to enhanced technology tools (e.g., a dynamic portal to access/apply care transformation tools and resources) will buoy continuous learning and improvement efforts. These resources will support the work of the improvement workforce (including patients and communities) by providing solutions that are informed by evidence but customizable to local practice settings. With key information/elements that are customizable for each local institution's needs/setting, these tools will be developed from, and continuously shaped by, the learning cycle(s) of LHSs locally and nationally.

CDOs will observe increased efficiency in improvement efforts, improved outcomes, and lower workforce burnout due to integration of continuous learning into every aspect of system processes.

Via a learning culture and dedicated resources to support its implementation, organizations will have ready access to measures of their own progress as an LHS by which to benchmark and validate the business case (i.e., ROI) for investing in LHS approaches.

National LHS Perspective Current State

*There is **no shared vision** broadly adopted across all key stakeholder groups about what the various national LHS components should look like to help focus efforts.*

LHS core values (296), leadership and process features, workforce competencies (for research professionals), and frameworks for computable biomedical knowledge have been defined, elaborated, and adopted by a nascent LHS community of practice. However, these approaches have not been formally adopted nor prioritized and resourced for implementation broadly at the national level.

*There is **no universally adopted mechanism for coordinating** the many efforts focused on achieving LHS results in unhelpful redundancies, inefficiency, and suboptimal progress toward goals.*

The framework for LHS implementation at a national level requires active collaboration among multiple stakeholders to enable standards and processes for data interoperability, research, and learning.

It is difficult for participants around the cycle to find, access, and implement useful information, resources, and tools.

Spread across many disparate/isolated systems and not packaged and organized in ways where they can be mapped to specific needs, existing information, resources, and tools are not represented in a standardized fashion to facilitate identification and application, nor are they evaluated adequately to support evidence-based use.

Continuous learning is not prioritized as a healthcare workforce imperative.

This and other challenges result in slow progress addressing suboptimal healthcare outcomes.

National LHS Ideal Future Vision

In the ideal future state, national LHS approaches will result in continuous improvement in Quintuple Aim outcomes. Continuous learning healthcare will provide information/evidence and resource flow resulting in **efficient and rewarding processes and desired outcomes** for participants at all points around the LHS cycle.

An LHS will harmonize policies and incentives from payers, regulatory bodies, and others to support a virtuous LHS cycle.

Harmonization of organizational and professional regulatory requirements for CQI and clinical performance and alignment of payment incentives to value-based care (i.e., targeted, real-time performance/outcome measures that build a learning and improvement dataset) reduce administrative burden for organizations and their healthcare workforce. As a result, organizations turn their time and effort toward LHS approaches that drive progress toward the Quintuple Aim. Regulatory bodies and policymakers continue their vigilance to reduce or eliminate unhelpful siloes and fragmented efforts, information, tools, and resources.

Having an LHS will be a national healthcare priority for policymakers, collaborative agencies, and Federal and foundational funders.

Policy leadership, collaboration, and funding approaches spur elaboration, endorsement, and implementation of LHS key principles (e.g., LHS core values (284), LHS competencies for researchers (285)) that make an interconnected community of practice possible.

An LHS will prioritize inter- and intraorganizational continuous learning and improvement as a workforce imperative.

Organizations and stakeholders that lead and inform continuous organizational and workforce learning (e.g., workforce development, performance management, accredited continuing education, teaming, and talent development) will support the local and national needs of LHSs.

Using an LHS will facilitate easy access to optimal tools/resources for continuous learning and improvement.

Optimal tools/resources for continuous learning and improvement may have the following characteristics:

- Provision of key information and simplified categorization (i.e., “tagging”) that allows end users to compare and contrast different tools and resources on the basis of resources required to implement, infrastructure requirements, workforce training requirements, etc.
- Alignment with harmonized regulatory and professional expectations (e.g., process improvement and outcome metrics are neatly aligned with endorsed measures such as NQF, CMS Quality Measures and Improvement Activities, NCQA, Hedis, etc.; CQI interventions clearly aligned with improvement outcomes: morbidity, mortality, opioid CDS aligned with opioid-related death and adverse drug events, ED/hospitalization metrics)
- Users/consumers have access to optimal LHS implementation tools/resources **when, where, and how they are needed** to optimize decisions, actions, and outcomes (e.g., offerings adhere to standards and are curated and accessible via integrated portals and marketplaces)

Assets Currently Available Related to Future Vision

Table B-7. Current AHRQ (& Other) Resources for LHSs includes a list of resources and tools currently available to support the care transformation (i.e., CQI) work of CDOs, support organizations, and QI professionals.

#	Resource	Current State/AHRQ: (Guidance, Evidence, Tools)
1	AHRQ Landing Page on LHSs	AHRQ conducts research and provides training, tools, and data to help healthcare delivery organizations of every size move toward becoming LHSs (24)
2	AHRQ Impact Case Studies (302)	Examples of how AHRQ tools and resources support QI and care transformation
3	AHRQ Tools for Quality and Patient Safety	Practical, research-based tools and other resources (303) to help a variety of healthcare organizations, providers, and others make care safer in all healthcare settings, such as the Reducing Diagnostic Errors in Primary Care Pediatrics Toolkit (304)
4	CDS Interventions /Artifacts	Tool to help primary care clinicians select preventive interventions for patients (ePSS) from CDS Connect
5	Opioid and Substance Use Resources	From opioid and substance use resources from The Academy (270)
6	EvidenceNOW Tools for Change	Tools for Change (75) to improve heart health from EvidenceNOW initiative
7	Tools for Clinicians and Providers	Tools for clinicians and providers
8	Tools for Hospitals and Health Systems	Tools for hospitals and health systems
9	Tools for prevention and Chronic Care	Tools for prevention and chronic care
10	Data Resources	Data resources (305)
11	Research Data and Tools	Research Data and Tools (306)
12	CAHPS database	CAHPS database (307) results from patient care experience assessment surveys
13	AHRQ Quality Indicators Website	AHRQ Quality Indicators (308)
14	PSNet	Primers, tools, and resources for improving patient safety (261)

15	PBRN	Information/resources for PBRNs (309)
16	EPC Program	As part of AHRQ's commitment to accelerating the spread of evidence-based best practices across LHSs, the EPC Program wants to help LHSs use the evidence from its evidence reports to improve patient care. This webpage showcases projects by the EPC program to help make evidence reports more useful for health systems.
17	CAHPS®	Under the CAHPS program (310), AHRQ funds, oversees, and works closely with a consortium of research organizations to conduct research on patient experience and develop surveys that ask consumers and patients to report on and evaluate their experiences with health plans, providers, and healthcare facilities. CAHPS® surveys play an important role as a QI tool for healthcare organizations that use the standardized data to: identify relative strengths and weaknesses in their performance; determine where they need to improve; and track their progress over time. Supporting and assessing the use of CAHPS surveys for QI purposes is one of the key objectives for the CAHPS grants.
19	The CAHPS Ambulatory Care Improvement Guide	The CAHPS Ambulatory Care Improvement Guide (311) is a comprehensive resource for health plans, medical groups, and other providers seeking to improve their performance in the domains of patient experience measured by CAHPS surveys of ambulatory care. Use this guide to help your organization: Cultivate an environment that encourages and sustains QI; Analyze the results of CAHPS surveys to identify strengths and weaknesses; Develop strategies for improving performance.
20	Teaching Evidence Assimilation for Collaborative Health Care (TEACH) 2009-2014: Building Evidence-Based Capacity Within Health Care Provider Organizations	"Clinical guidelines, prediction tools, and computerized decision support (CDS) are underused outside of research contexts, and conventional teaching of evidence-based practice (EBP) skills fails to change practitioner behavior. Overcoming these challenges requires traversing practice, policy, and implementation domains. In this article, we describe a program's conceptual design, the results of institutional participation, and the program's evolution." (312)

Additional Considerations for AHRQ

Addressing the human capital aspects of LHS implementation may benefit from engagement with those organizations, professionals and other stakeholders that foster learning and improvement for individuals, teams, and organizations within (and external to) the healthcare sector. These potential partners may be drawn from the following domains:

- **Healthcare Workforce Development**—overarching strategies for the recruitment, training, continuous development, and retention of those people who work within healthcare organizations
- **Talent Development**—building the knowledge, skills, and abilities of others and helping them develop and achieve their potential so that the organizations they work for can succeed and grow
- **Performance Management**—a shared understanding, framework, processes, and measures that support continuous learning and improvement of individuals and teams
- **Continuous Professional Development (CPD)**—the learning journey of the healthcare professional as they seek to improve their competence and expertise, supported by continuing medical education and other personal/professional activities by the learner with the intention of providing safe, legal, and high-quality services aiming at better health outcomes for patients and communities
- **Accredited Continuing (Medical) Education (CE/CME)**—the process by which healthcare professionals engage in activities designed to support their continuing professional development with learner-centered activities that support their ability to provide high-quality, comprehensive, and continuous patient care and service to the public or their profession with content derived from multiple instructional domains focused not only on providing clinical care but also on developing those attitudes/skills necessary for the individual to contribute as an effective administrator, teacher, researcher, and team member in the healthcare system
- **Interprofessional continuing education (IPCE)**—members from two or more professions learning with, from, and about each other to enable effective collaboration and improve health outcomes

^[1] Details presented here focus on LHS, CQI, and QI for individual CDOs and organizations that support this work, not the broader ecosystem.

^[2] For a historical review of the development of LHSs, see the 2018 article from Rubin, et al. in Learning Health Systems Open Access (349).

^[3] Improving quality of care, cost of care, patient experience, and provider experience. (22)