Communicable disease control programmes and health systems: an analytical approach to sustainability

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There is renewed concern over the sustainability of disease control programmes, and re-emergence of policy recommendations to integrate programmes with general health systems. However, the conceptualization of this issue has remarkably received little critical attention. Additionally, the study of programmatic sustainability presents methodological challenges. In this article, we propose a conceptual framework to support analyses of sustainability of communicable disease programmes. Through this work, we also aim to clarify a link between notions of integration and sustainability. As a part of development of the conceptual framework, we conducted a systematic literature review of peer-reviewed literature on concepts, definitions, analytical approaches and empirical studies on sustainability in health systems. Identified conceptual proposals for analysis of sustainability in health systems lack an explicit conceptualization of what a health system is. Drawing upon theoretical concepts originating in sustainability sciences and our review here, we conceptualize a communicable disease programme as a component of a health system which is viewed as a complex adaptive system. We propose five programmatic characteristics that may explain a potential for sustainability: leadership, capacity, interactions (notions of integration), flexibility/adaptability and performance. Though integration of elements of a programme with other system components is important, its role in sustainability is context specific and difficult to predict. The proposed framework might serve as a basis for further empirical evaluations in understanding complex interplay between programmes and broader health systems in the development of sustainable responses to communicable diseases.

Keywords Health system, communicable disease control programme, sustainability, integration, conceptual framework
KEY MESSAGES

- There are renewed concerns over the sustainability of disease control programmes, and the re-emergence of policy recommendations to integrate programmes with general health systems. However, there is a paucity of empirical evidence regarding whether integration of programmes within broader health systems improves the likelihood of programmatic sustainability.

- Building upon an explicit conceptualization of health systems for the analysis of programmatic sustainability is important if lesson-learning is to be effective and sustainability embedded in programme implementation.

- To advance research on sustainability in health systems, empirical studies drawing upon foundations in the theoretical and conceptual literature are needed.

Introduction

Over the past decade, development assistance for health increased rapidly particularly in areas addressing priority communicable diseases (Brugha 2008; McCoy et al. 2009; Ravishankar et al. 2009; Samb et al. 2009; Murray et al. 2011). The rapid inflow of substantial assistance coincided with the proliferation of actors involved in assisting countries to achieve global disease control targets (Shiffman 2008; McCoy et al. 2009; Shiffman et al. 2009; Balabanova et al. 2010). This supportive financial environment facilitated the introduction and rapid scale-up of novel disease control interventions. In recent years, the economic crisis in the West has led to a slowdown in financial commitments and a demand that funding results in strengthened health systems as well as improved disease control (Leach-Kemon et al. 2012; Dye et al. 2013).

These changes have led to a revisiting of two long-standing and related debates in international development for health: one relates to the sustainability of donor-funded interventions (Bossert 1990; Brown 1998; Garrett 2007; Yang et al. 2010; Rushton 2011) and the other relates to a debate on the integration of priority health interventions and general health services (Gonzalez 1965; Mills 1983; Oliveira-Cruz et al. 2003; Mills 2005; Atun et al. 2008). Debates surrounding sustainability were historically related to tensions between the length of time donors’ funding made available and the time required to address public health problems (Brown 1998; Yang et al. 2010). Proponents of improved integration of disease programmes into broader health systems have historically argued that this would improve coverage, access, equity and efficiency as well as the sustainability of disease control interventions (WHO 1965; Feenstra and Visschedijk 2002; Unger et al. 2003; Visschedijk et al. 2003; Briggs and Garner 2006; Unger et al. 2006; Atun et al. 2008; Mosngaga et al. 2008). By contrast, proponents of ‘disease-centred’ (or vertical) approaches to disease control have argued that dedicated disease-specific programmes are necessary to ensure functional capacity is sustained and control ensured most effectively and efficiently (Walsh and Warren 1979; Lush et al. 1999; Raviglione and Pio 2002; Lammie et al. 2006).

In spite of the broad concern regarding the contemporary importance of sustainability of communicable disease programmes, the conceptualization of this issue has received remarkably little critical attention. There is a paucity of evidence regarding whether integration of communicable disease programme components within broader health systems improves the likelihood of programmatic sustainability. For several reasons, studying sustainability of health programmes presents conceptual and methodological challenges. Different ideas exist regarding programmatic sustainability for actors in various health research disciplines, contexts and over different time frames (Shediac-Rizkallah and Bone 1998; Gruen et al. 2008; Wilsey Stirman et al. 2012). What integration in a health system constitutes also lacks conceptual agreement (Atun et al. 2008; Shigayeva et al. 2010). Programmatic sustainability is understood as a phenomenon influenced by multiple, often interrelated, contextual factors (Greenhalgh et al. 2004; Sibthorpe et al. 2005; Gruen et al. 2008; Humphreys et al. 2008; Scheirer and Dearing 2011; Wilsey Stirman et al. 2012). However, commonly applied (quasi)-experimental and traditional evaluation approaches have limitations in explaining such complexity (Greenhalgh et al. 2012; Wilsey Stirman et al. 2012).

Health systems, and programmes within, are increasingly recognized as complex systems (Atun and Menabde 2008; Sturmberg and Martin 2009; Adam and de Savigny 2012; Paina and Peters 2012). Theory-based approaches have been proposed as research methodology to study complexity in health systems (Coker et al. 2004; Byng et al. 2005; Van Belle et al. 2010; Sengooba et al. 2012). Our work presented here builds on a view of health systems as complex adaptive systems. In this article, we propose a conceptual framework to support analyses of sustainability of communicable disease programmes. The framework for programmatic sustainability extends earlier conceptual and analytical developments by Atun et al. (2004), Coker et al. (2004), and Atun and Menabde, (2008). We extend this earlier work, drawing on constructs related to sustainability derived from complex systems’ theories, previous work on conceptualization of integration and health system (Shigayeva et al. 2010) and a systematic literature review of peer-reviewed literature on concepts, definitions, analytical approaches and empirical studies on sustainability in health systems. Through this work, we also aim to clarify a link between notions of integration and sustainability.

Theoretical background

Sustainability and integration

Sustainability is a neologism drawn from ‘sustain’, which means ‘to supply with sustenance’, ‘to make something to be kept up, prolonged or carried on’ (Oxford English Dictionary).
The sustainability concept originates in research on the behaviour of ecological and socio-economic systems (Goodland 1995; Hueting and Reijnders 1998), an interdisciplinary research area currently referred to as ‘sustainability science’ (Clark 2007). Though there is no agreement on its operational definition, integral to the sustainability concept is the focus on future needs, where equity, effectiveness and efficiency are central concerns (WCED 1987; Kemp et al. 2005).

Within the sustainability sciences discourse, the essence of a system’s sustainability is increasingly understood as a system’s resilience (Dovers 1996; Gunderson 2000; Holling 2001; Folke et al. 2002; Fiksel 2006). There are two broad perspectives on resilience. The first, based on an understanding of nature and society as systems functioning near equilibrium (Holling 1973), is inspired by system dynamic and catastrophe theories (Forrester 1961; Thom 1975). In this discourse, resilience is understood as the degree and speed that a system can withstand threats, disturbances or catastrophic events, and return to a steady equilibrium or a stable state (Fiksel 2003; Mayer 2008). The other view of resilience, which builds on the perspective of complex adaptive systems, emphasizes adaptive capacity and possibilities of multiple equilibriums (Gunderson 2000; Brand and Jax 2007). In this view, the theory emphasizes non-linear interactions among a system’s agents under constantly changing conditions where uncertainty, shocks and surprises are inevitable. In complex adaptive systems, resilience incorporates notions of adaptation, self-organization and learning. This perspective focuses on how to persist through continuous development in the face of change and how to innovate and transform into new and more desirable configurations (Folke et al. 2002; Fiksel 2003; Folke 2006). In this discourse, resilience is viewed as a socially instituted process of adaptive change, in which innovation is a necessary element (Kemp et al. 2005).

The integration concept is central to system theories (Checkland 1981; Scott 1987; Kodner and Spreeuwenberg 2002; Nolte and Mckee 2008). The term means ‘organic part of a whole’ or ‘reunited parts of a whole’ (Kodner and Spreeuwenberg 2002). There is a wide range of concepts related to integration. In health systems research, for example, these various concepts include notions of linkage, co-operation, collaboration, partnerships, co-ordination, mergers or networks (Shigayeva et al. 2010). Systems are composed of separate but interacting and interdependent agents (e.g. individuals, organizations). Connectivity or interconnectedness (notions of integration) among agents bonds the entity together, thus potentially enabling it to achieve common goals and optimal results (Kodner and Spreeuwenberg 2002). In complex adaptive systems (Box 1), both the absolute number of connections and the strength of these connections play consequential roles in a system’s functioning and adaptations (Eidelson 1997) and, thus, are important for resilience (Holling 2001; Fiksel 2003). In a sense, a system’s connectivity relates to flexibility or rigidity of internal control (Holling 2001). Inadequate connections may challenge a co-ordinated response to external pressures; however, excessive connections may reduce flexibility and a potential for adaptation (Eidelson 1997; Holling 2001).

Though the term ‘sustainability’ is not commonly used by organizational theorists, an organization’s viability, survival, adaptation and performance are central questions theorists attempt to address. The central argument proposed by the open system model, for example, is that all organizations depend on exchanges with other systems (Scott 1987; Jaffee 2001). A more complex and uncertain environment drives organizations to adapt and change their arrangements for the purposes of survival (i.e. performance, viability, legitimacy). The contingency theory (Lawrence and Lorsch 1967; Galbraith 1973) and resource dependency theory (Pfeffer and Salancik 1978; Aldrich 1979) argue that organizations generally strive for improved performance. Thus, they often build integrative relations with other organizations (or modify internal structure) in the interest of effectiveness and efficiency.

There are tensions in the above-mentioned theoretical perspectives. Along with integration, organizational theorists argue that differentiation (or specializations) and maintaining autonomy are also necessary for organizational viability and survival (Jaffee 2001). Similar tensions could be found in the theoretical literature on inter-organizational relations within other disciplines such as strategic management, economics, sociology and political sciences (Whetten 1981; Oliver 1990). Likewise, propositions from sustainability science suggest that independence and diversity of a system’s agents (both structural and functional) are necessary for a system’s resilience. These factors provide opportunities for innovations and development as they are a source of learning and a resource base for adaptation and reorganization (Kay et al. 1999; Kemp et al. 2005).

**Box 1. Properties of complex adaptive systems**

- Multiple interdependent agents interact in non-linear manner, sometimes involving feedback loops, both positive and negative. Small changes in the environment or within a system may lead to massive system change and vice versa.
- Open to the environment, the system’s agents continuously interact with and co-evolve with its environment.
- Path-dependent, non-reversible processes have similar starting points yet lead to different outcomes, even if they follow the same rules. Outcomes are sensitive not only to initial conditions but also to choices made along the way.
- Structured as scale-free networks, which are dominated by a few focal points or hubs with an unlimited number of links, following a power-law distribution.
- Capable of self-organizing, a pattern of behaviour emerges iteratively through dynamic and non-linear interactions among the system’s agents and components. As a result, the organized behaviour of a system is larger and more complex than the sum of its parts.

Adapted from Paina and Peters (2012) and Sturmberg and Martin (2009).

**Health system as complex adaptive systems**

Over the past decade, there has been a growing recognition that health systems, including programmes and organizations within, possess properties of complex adaptive systems (Box 1) (Plsek and Greenhalgh 2001; Atun and Menabde 2008; Sturmberg and Martin 2009; Paina and Peters 2012).
In their conception of health systems, Atun et al. (2004) characterize a system’s components in terms of governance, financing, planning, service delivery, demand generation and evaluation, and they argue that the configuration of these contribute to the achievement of health goals in an equitable, effective and efficient manner (Atun and Menabde 2008). Health systems are open systems situated within broader demographic, economic, political, legal and regulatory, epidemiological, socio-demographic and technological contexts (Coker et al. 2004). Embedded within health systems are programmes, and their organizational arrangements and interventions are interlinked (Frenk 1994), their dynamic relationships involve positive and negative feedback loops, collectively shaping the health system’s behaviour (Atun and Menabde 2008).

Theory-based approaches have been proposed for the evaluation of complex health interventions, programmes and policy initiatives (Coker et al. 2004; Byng et al. 2005; Van Belle et al. 2010; Sseengooba et al. 2012). Though a theory-based approach (also referred to as theory-driven evaluation or theory-driven inquiry) and that proposed by Coker et al. (2004) differ in operational definitions and research strategy (Coryn et al. 2011; Marchal et al. 2012), common principles include the development, testing and refinement of an explicit framework or model on how a programme (or a policy) may result in observed or intended outcomes. We follow Coker et al. (2004) [who in turn build on realist evaluation (Pawson and Tilley 1997)] in the development of a programme theory that may provide a better explanation of programmatic sustainability. This approach considers systematically disease control programmes, the health systems within which they sit and their broader context.

Our view accepts the uncertainty of sustainability phenomenon, which concerns future scenarios. What is possible, as suggested by Alexander et al. (2003), is to identify a potential for sustainability through an analysis of sustainability by proxy on the basis of discoverable capabilities or characteristics, which are hypothesized precursors of sustainability. We extend the work of Atun et al. (2004), Coker et al. (2004), and Atun and Menabde (2008) by proposing a definition of sustainable disease control programme, and programmatic characteristics (or capabilities), which can explain a potential for programmatic sustainability. We did so by conducting a systematic literature review. Next, we present the methods of the literature review and its results. This is followed by the presentation of the proposed framework for programmatic sustainability. We conclude the article with the discussion of limitations to the proposed conceptual approach.

Methods

Our review includes conceptual and/or analytical frameworks, reviews (overviews) of conceptual or methodological approaches to sustainability, systematic reviews of sustainability in health systems and empirical studies. The detailed methodology of the systematic literature review, search strategy and the process of selecting papers and studies are presented in Supplementary Appendix S1. Briefly, we searched Medline, Embase and Cochrane databases for papers published in English language between 1 January 1980 and 1 November 2012. The search was limited to papers accessible through the University of London library services. We also reviewed bibliographies of retrieved papers to identify further publications. The search strategy included key terms related to the concept of sustainability including ‘sustain’*, ‘resilience’*, ‘viability’*, ‘institutionalization’*, ‘routinization’*, ‘durability’, ‘stability’, ‘persistence’, and ‘continuation’. The search was restricted to Medical Subject Headings (MeSH) under ‘health care’, ‘health services’, and key terms ‘health program’*, ‘health intervention’, ‘health system’.

Identified frameworks were analysed through question probes: (i) what are the characteristics or capabilities that are assumed to be attributes of a sustainable health programme (or an organization, not limited to a single intervention) and (ii) how are health systems and broader political, socio-economic and epidemiological contexts conceptualized and acknowledged? The analysis of identified conceptual frameworks and empirical studies included a synthesis of attributes of the sustainability of a health programme (or an organization). Thematic analysis approach has been used for synthesis (Thomas and Harden 2008). We followed established principles for analysis of qualitative data (Pope et al. 2000; Green and Thorogood 2009). Thematic framework was developed during the analysis of conceptual/analytical frameworks. At the initial stage, one researcher extracted section/s of included papers that was outlining factors proposed as influencing sustainability. Extracted sections were coded line-by-line. Codes were compared, refined and grouped into the emerging themes. The initial grouping of emerging themes was implemented according to the level of a health system (an intervention, organization, health system, broader context). A second researcher reviewed the coded data and emerging themes. Through collaborative discussions, emerging themes were interpreted to infer broader programmatic (or organizational) capabilities or characteristics (i.e. higher-order themes). Characteristics of a health system and contextual environment were also summarized. The thematic framework, developed during the analysis of frameworks, was applied for coding, and summarizing the attributes of sustainability found in empirical studies.

Results

Definitions and perspectives on sustainability in health systems

We identify two aspects in identified definitions of sustainability. The first is a focus on ‘what is being sustained’ (e.g. resources, performance or goals). The second is ‘what level(s) or component of a health system’ is being considered, whether a health intervention (or an innovation, project, programme), a health organization (or a health service organization, community-based organizations, institution, coalition), a system’s functional or structural component (e.g. funds, or human resources) or the overall health system. Illustrative examples of definitions are presented in Table 1.

Sustainability of health interventions.

Definitions of the sustainability of interventions from a public health perspective emphasize the maintenance of benefits to stakeholders over time (Shediac-Rizkallah and Bone 1998; Mancini and Marek 2004; Pluye et al. 2004b; Swerissen and
Table 1 Selected definitions of sustainability in health systems

<table>
<thead>
<tr>
<th>Perspective or research area</th>
<th>Level/component of a health system</th>
<th>Health organization</th>
<th>Health system</th>
</tr>
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<tbody>
<tr>
<td>Public health</td>
<td>'Sustainability is not only the long-term survival of project related changes, but also continued effectiveness and capacity to adapt or replace interventions or programmes within context that constantly changes.' (Bowman et al. 2008)</td>
<td>'Maintaining adequate service coverage that will provide continuing control of a health problem, continuing to deliver benefits over long period of time, becoming institutionalized within an organization, and continuing to respond to community issues.' (Nelson et al. 2007)</td>
<td>'The sustainability of primary health care is the production of health outputs and outcomes at optimized efficiency with uninterrupted inputs.' (Knappenberg et al. 1997)</td>
</tr>
<tr>
<td>International development</td>
<td>'Sustainability is the ability of a health project or programme to deliver health services or sustain benefits after major technical, managerial and financial support has ceased.' [USAID, cited in Lafond, 1995a]</td>
<td>'Sustainability is about continued effectiveness over time, which requires the sustained conversion of institutional capacity into performance. It also requires constant adjustment to changes in environment and circumstance.' (Brown 1998)</td>
<td>'Sustainability of a health system is defined as a capacity of the health system to function effectively over time with minimum external input.' (Lafond 1995a)</td>
</tr>
<tr>
<td>Innovations, organizational change</td>
<td>'Sustainability is a process of ensuring an adaptive prevention system and a sustainable innovation that can be integrated into ongoing operations to benefit diverse stakeholders.' (Johnson et al. 2004),</td>
<td>'When new ways of working and improved outcomes become the norm. Not only the process and outcomes have changed but thinking and attitudes behind them are fundamentally altered and the systems behind them are transformed in support...Sustainability means holding the gains and evolving as required.' (NHS Modernization Agency definition, cited in (Greenhalgh et al. 2004)),</td>
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<tr>
<td>Systems</td>
<td>The system is sustainable when it has the capacity to initiate desired changes, or adapt to changes in demand or in environmental conditions while ensuring resources and desired outputs.' (Olsen 1998)</td>
<td>'A sustainable health system has three key attributes: affordability, for patients and families, employers, and the government [...]; acceptability to key constituents, including patients and health professionals; and adaptability; because health and health care needs are not static (i.e. a health system must respond adaptively to new diseases, changing demographics, scientific discoveries, and dynamic technologies in order to remain viable).' (Fineberg 2012)</td>
<td></td>
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</tbody>
</table>

*a An intervention, innovation, project or programme.
*b A health service organization, community-based organization, institution, partnership or coalition.
Analytical Approach to Programmatic Sustainability

Crisp 2004; Hanson et al. 2005). These benefits (i.e. ‘what is to be sustained’) are defined as improvements in health (Hanson et al. 2005), or continued control over a health problem through maintaining sufficient levels of effectiveness, accessibility, acceptability or coverage of interventions (WHO 2002; Nelson et al. 2007).

Early concepts within international assistance discourse focused on the continuation of interventions or benefits brought about by a donor’s project, with an emphasis on financial self-sufficiency (Bossert 1990; Lafond 1995a). The only focus on a post-project financial mechanisms and an overemphasis on quick results have been criticized as doing little in promoting sustainability (Brown 1998). Subsequently, there has been a shift towards sustaining institutional capacity generated by donor aid (Brinkerhoff and Goldsmith 1992; Sarriot et al. 2004; Bennett et al. 2011).

Several researchers view the sustainability of a health intervention as a multidimensional concept, which includes several aspects of ‘what to sustain’ outlined above including: continuing benefits to stakeholders, institutionalization of interventions within organizational settings and maintaining capacity of implementing entity (e.g. a community or an organization) (Shediac-Rizkallah and Bone 1998; Johnson et al. 2004; Sarriot et al. 2004; Cassidy et al. 2006; Edwards et al. 2007; Nelson et al. 2007; Scheirer and Dearing 2011).

Sustainability of health organizations.
The ‘what’ to sustain in concepts of sustainability of health organizations includes the organization’s longevity or viability (Rog et al. 2004; Cassidy et al. 2006), maintenance of organizational capacity, goals and philosophy (Stroult and Manteuffel 2007) and bringing benefits to users of services or meeting population needs and demands (Knippenberg et al. 1997; Olsen 1998; Alexander et al. 2003; LaPelle et al. 2006; Humphreys et al. 2008).

Definitions from perspectives of organizational learning, organizational sociology and systems theories view an essence of sustainability as continuously meeting the changing needs of stakeholders or the ability to perform in a changing contextual environment. This perspective emphasizes notions of alignment, connectivity, adaptability or responsiveness to change (Olsen 1998; Whittaker et al. 2004; Gruen et al. 2008). Several authors do not separate conceptually the sustainability of a certain intervention from the organization’s sustainability (Nilsen et al. 2005; Cassidy et al. 2006). Others argue that the aim of sustainability should be to sustain the ideas, cultures, beliefs or principles underlying innovation or overall organizational goals rather than an intervention per se (Virani et al. 2009).

Sustainability of health systems.
There have been few conceptual developments related to the sustainability of an overall health system. A central focus of policy debates has historically been on financial sustainability (Lafond 1995b; Stuart and Adams 2007; Thomson et al. 2009; Fineberg 2012; Pannullo et al. 2012). However, most authors acknowledge that the ‘what’ of sustainability in any health system includes attaining the health system’s goals, which are improved health status of the population, protection against health-related financial risks, responsiveness to needs and satisfaction of consumers’ expectations (Frenk 1994; Murray and Frenk 2000; Atun and Menabde 2008; de Savigny and Adam 2009; Shakarishvili et al. 2010). Several authors also agree that among intermediate objectives are notions of effectiveness, efficiency and equity (Shakarishvili et al. 2010). From an economic perspective, for example, a health system’s financial sustainability has been defined as ‘maximizing the attainment of a health system’s goals subject to constraints of aligning revenue and expenditure’ (Thomson et al. 2009).

Frameworks for analysis of sustainability in health systems
Through the literature review, we identified 29 conceptual frameworks for analysis of sustainability in health systems (Table 2, Supplementary Appendix S2). All conceptual frameworks identified address questions of ‘what’ is being sustained and what factors might determine sustainability. Twenty were frameworks related to the sustainability of a health intervention (or an innovation, programme); six were aimed at analyses of sustainability of health organizations, and three were frameworks for the analysis of health system sustainability. Eighteen frameworks draw on theoretical perspectives to guide the analysis. The majority of frameworks broadly apply perspectives from organizational theories (Table 2, Supplementary Appendix S2), including propositions to utilize complex system theories to study sustainability in health system (Olsen 1998; Greenhalgh et al. 2004; Nelson et al. 2007; Gruen et al. 2008; Humphreys et al. 2008). The remainder was based upon researchers’ experience and/or literature review.

Ten frameworks were proposed within the international assistance discourse (Bossert 1990; Brinkerhoff and Goldsmith 1992; Stefanini and Ruck 1992; Berman 1995; Lafond 1995a; Knippenberg et al. 1997; Sarriot et al. 2004; Stephenson et al. 2004; Torpey et al. 2010; Bennett et al. 2011) (Table 2). These conceptual frameworks focus particularly on the operational and/or financial self-sufficiency of local organizations or institutions after the exit of international assistance. With few exceptions (Brinkerhoff and Goldsmith 1992; Berman 1995), these frameworks are not explicitly guided by theory.

A number of frameworks for analysis of sustainability of health programmes or organizations have included notions of integration as one of the determinants, or a dimension, of sustainability (Bossert 1990; Olsen 1998; Shediac-Rizkallah and Bone 1998; Alexander et al. 2003; Mancini and Marek 2004; Sarriot et al. 2004; Hanson et al. 2005; Gruen et al. 2008; Humphreys et al. 2008; Scheirer and Dearing 2011). In these sustainability frameworks, definitions of what integration entails differ (e.g. collaboration, co-ordination, supporting relationships, alignment). With few exceptions (Stefanini and Ruck 1992; Berman 1995; Lafond 1995a; Knippenberg et al. 1997; Olsen 1998), identified frameworks do not prioritize questions of efficiency, a cornerstone in sustainability discourse.

We found most frameworks proposed tend to be deterministic in nature where sustainability is viewed as an end goal, one that is dependent upon processes that are assumed to be a somewhat linear and predictable. The broader contextual environment was included in most frameworks as determinants of sustainability. A limitation of identified frameworks for the analysis of a programme’s sustainability is the lack of an explicit
conceptualization of what a health system is. Moreover, although the context is acknowledged, sustainability of health interventions or programmes tends to be analysed in isolation from the overall health system. Consequently, frameworks developed thus far cannot fully provide explanations on what role the different health system’s functions, including integration of programmes with the health system’s components, may play in sustainability of interventions or programmes.

### Table 2: Identified frameworks for sustainability in health systems

<table>
<thead>
<tr>
<th>Level/component of a health system</th>
<th>Theoretical underpinnings or background</th>
<th>Framework/authors</th>
<th>Specific research area</th>
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<tbody>
<tr>
<td>Health intervention(^b)</td>
<td>Diffusion of innovations theory</td>
<td>Bowman et al. (2008)</td>
<td>Quality assurance initiatives in health-care settings</td>
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<td></td>
<td></td>
<td>Goodman et al. (1993)</td>
<td>Health promotion programmes</td>
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<td></td>
<td></td>
<td>Shnediac-Rizkallah and Bone (1998)</td>
<td>A community-based health intervention</td>
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<td></td>
<td></td>
<td>Edwards et al. (2007)</td>
<td>Patient safety and quality improvement projects</td>
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<td></td>
<td>Theories of organizational change and innovation</td>
<td>Greenhalgh et al. (2004)</td>
<td>Innovations in health service delivery and organization</td>
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<td></td>
<td></td>
<td>Johnson et al. (2004)</td>
<td>Health prevention innovations</td>
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<td></td>
<td></td>
<td>Slaghuis et al. (2011)</td>
<td>New clinical practices in health-care settings</td>
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<tr>
<td></td>
<td>Organizational learning theory</td>
<td>Puyre et al. (2004b)</td>
<td>Public health programmes</td>
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<td></td>
<td></td>
<td>Virani et al. (2009)</td>
<td>New practice in health care</td>
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<td></td>
<td>Sociological research, normalization process model</td>
<td>May and Finch (2009)</td>
<td>Complex innovations in health care</td>
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<td></td>
<td>Ecological systems theory</td>
<td>Gruen et al. (2008)</td>
<td>A health programme</td>
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<td></td>
<td>Hanson et al. (2005)</td>
<td>Safety promotion interventions</td>
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<tr>
<td></td>
<td>Organizational theory, formation of inter-organizational relationships</td>
<td>Nelson et al. (2007)</td>
<td>Tobacco control programmes</td>
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<td></td>
<td>International development initiatives(^c)</td>
<td>Bossert (1990)</td>
<td>A health project</td>
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<td>Sarriot et al. (2004)</td>
<td>NGO-supported child survival projects</td>
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<td>Stephenson et al. (2004)</td>
<td>Family planning programmes</td>
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<td></td>
<td></td>
<td>Stefanini and Ruck (1992)</td>
<td>A health project</td>
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<td></td>
<td></td>
<td>Bennett et al. (2011)</td>
<td>HIV/AIDS programme</td>
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<tr>
<td></td>
<td>Researchers’ experiences, literature review</td>
<td>Mancini and Marek (2004)</td>
<td>Community-based family programmes</td>
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<td></td>
<td></td>
<td>Scheirer and Dearing (2011)</td>
<td>Public health programmes</td>
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<tr>
<td></td>
<td>New institutional theory</td>
<td>Brinkerhoff and Goldsmith (1992)</td>
<td>Various areas, including development in health</td>
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<td></td>
<td>Organizational theory, open systems</td>
<td>Olsen (1998)</td>
<td>Health services</td>
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<td></td>
<td>Organizational theory, formation of inter-organizational relationships</td>
<td>Rog et al. (2004)</td>
<td>Community coalitions/partnerships for health</td>
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<td>Alexander et al. (2003)</td>
<td>Community health partnerships</td>
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<tr>
<td></td>
<td>Researchers’ experiences, literature review</td>
<td>Humphreys et al. (2008)</td>
<td>Health services in rural or remote areas</td>
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<td>Torpey et al. (2010)</td>
<td>HIV/AIDS service organizations</td>
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<td></td>
<td>International development initiatives(^d)</td>
<td>Lafond (1995a)</td>
<td>Health system</td>
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<td></td>
<td></td>
<td>Knippenberg et al. (1997)</td>
<td>Primary health-care/health system reform initiative</td>
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</tbody>
</table>

\(^a\)Detailed background is outlined in the Supplementary Appendix S2.

\(^b\)An intervention, innovation, project or programme.

\(^c\)Guides or experiences of donor agencies, e.g. United States Agency for International Development (USAID), United Nations Joint Programme on HIV/AIDS (UNAIDS), World Bank.

\(^d\)A health service organization, community-based organization, institution, partnership or coalition.

**Empirical studies on sustainability in health systems**

One hundred and eight empirical studies met eligibility criteria and were accessible for our review (Supplementary Appendix S3). Seventy-three studies were conducted in industrialized countries and 35 in low-middle-income countries. Most studies (\(n = 70\)) focused on an assessment of the sustainability of health interventions. Thirty-six explored the sustainability of organizations. We identified only two studies that analysed the
sustainability of a health system (Lafond 1995a; Pammolli et al. 2012). The majority of studies were concerned with the continuation of interventions, programmes, health reform initiatives or functioning of established organizations (e.g. community-based coalitions or non-governmental organizations (NGOs)) after the conclusion of external funding, technical assistance or a research study.

Table 3 presents a summary of study designs. Broadly, studies were case studies, descriptive narratives of experiences, evaluation studies (including economic evaluations), surveys or of quasi-experimental design (before and after intervention, or exposed and not exposed to an intervention). Several studies developed quantitative indicators or indices for measuring benefits or outcomes produced by the programme as a proxy for sustainability (McDermott et al. 2003; Mancini and Marek 2004; Stephenson et al. 2004; Amazigo et al. 2007; Glisson et al. 2008; Sarriot et al. 2008).

**Synthesis: main attributes of a sustainable health programme and role of health system in programmatic sustainability**

In our analysis, five broad characteristics of a sustainable programme (or an organization) have emerged: (1) capability to govern, lead and manage; (2) resources and capability to plan and implement activities; (3) ability to adapt to changing internal or external institutional environment; (4) capability to build relationships and interactions inside/outside programmes and (5) ability to bring about results or attain goals. Additionally, health system and contextual factors emerged as important determinants of programmatic sustainability.

**Capability to govern, lead and manage (we term this ‘leadership’).**

Leadership has been conceptualized as one of the central capabilities and skills of stakeholders, which unites other aspects of sustainability. Included here are competencies such as setting attainable organizational goals, strategic financial and organizational planning, resource mobilization, community mobilization, strategic use of monitoring and evaluation (Bossert 1990; Brinkerhoff and Goldsmith 1992; Knippenberg et al. 1997; Olsen 1998; Alexander et al. 2003; Mancini and Marek 2004; Hanson et al. 2005; Gruen et al. 2008). Leadership is also conceptualized as commitment, taking responsibility and ownership for actions, engaging others and handling conflicts (Olsen 1998; Alexander et al. 2003; Johnson et al. 2004). Leaders also have a role in creating an environment for continuously supporting the development of the skills of those working in an organization (Mancini and Marek 2004; Hanson et al. 2005).

The majority of empirical studies emphasized the importance of leadership. Some studies found that the presence of individual charismatic leaders (‘champions’) was important (Goodson et al. 2001; Scheirer 2005; Crone et al. 2006; Edwards and Roelofs 2006). Other studies concluded that sustainability depends on the leadership’s competencies as related to collective efforts, norms and organizational culture. These competencies included managerial expertise in strategic and financial planning, fundraising, building trust and strategic relations outside the organization and generating political support.

| Table 3 Characteristics of included empirical studies on sustainability in health systems |
|---------------------------------|---------------|--------------|
|                                    | Country setting | High income | Low-middle-income |
| All studies reviewed              | 108            | 73           | 35 |
| Level of health system            |                |              |    |
| Interventiona                      | 70             | 52           | 18 |
| Health organizationb              | 36             | 20           | 16 |
| Health system                     | 2              | 1            | 1  |
| Research area                     |                |              |    |
| Health promotion                  | 29             | 29           | 0  |
| Chronic diseases management       | 9              | 9            | 0  |
| Tobacco control                   | 3              | 3            | 0  |
| Mental health                     | 7              | 7            | 0  |
| Communicable diseases control     | 19             | 1            | 18 |
| Maternal and child health         | 5              | 1            | 4  |
| Reproductive and family health    | 2              | 1            | 1  |
| Primary care services             | 13             | 8            | 5  |
| Patient safety and quality of care| 4              | 4            | 0  |
| Health system reform initiatives  | 10             | 4            | 6  |
| Other                            | 7              | 6            | 1  |
| Study design                      |                |              |    |
| Quasi-experimental                | 10             | 6            | 4  |
| Survey                           | 19             | 16           | 3  |
| Case study                       | 17             | 10           | 7  |
| Multiple case study              | 18             | 15           | 3  |
| Multiple methods evaluation      | 13             | 6            | 7  |
| Qualitative methods evaluation   | 11             | 9            | 2  |
| Economic evaluation              | 7              | 3            | 4  |
| Description (narrative)          | 8              | 2            | 6  |
| Other                            | 5              | 5            | 0  |

*a An intervention, innovation, project or programme.
*b A health service organization, community-based organization, institution, partnership or coalition.

(Bossert 1990; Jana et al. 2004; Mancini and Marek 2004; Baum et al. 2006; Plochg et al. 2006; Stevens and Peikes 2006; Nelson et al. 2007; Stroul and Manteuffel 2007; Toledo Romani et al. 2007; Savaya et al. 2008). Other traits of leadership found in the studies include a long-term vision for how to address population’s health problems (Alexander et al. 2003; Feinberg et al. 2008), a vision on the value of innovations (Evashwick and Ory 2003; Barnett et al. 2004; Whittaker et al. 2004; Bradley et al. 2005), the ability to avoid competing objectives and to provide clarity in the roles and responsibilities of subordinate personnel/departments (Wakerman et al. 2005; Bailie et al. 2006).

**Resources and capability to plan, implement and evaluate activities (‘capacity’).**

All frameworks included ‘capacity’; however, definitions of what capacity encompasses varied. In general, capacity included...
structures and processes (e.g. planning, execution, evaluation) related to financing, human resources (including managerial), medicines and technologies, physical infrastructure, and monitoring and evaluation capabilities (Bamberger and Cheema 1990; Stefanini and Ruck 1992; Knippenberg et al. 1997; Olsen 1998; Shediac-Rizzkallah and Bone 1998; Johnson et al. 2004; Pluye et al. 2004a; Nelson et al. 2007; Humphreys et al. 2008; Bennett et al. 2011). Funding was defined as essential for sustainability in several frameworks. This aspect of capacity included stakeholders’ abilities to analyse funding needs, mobilize sufficient funds, evaluate and use funds efficiently (Stefanini and Ruck 1992; Lafond 1995a; Knippenberg et al. 1997; Mancini and Marek 2004; Sarriot et al. 2004; Torpey et al. 2010; Scheirer and Dearing 2011).

The availability of adequate funding, infrastructure and commodities, and qualified and trained staff were identified as factors influencing sustainability in a number of empirical studies (Prasad and Costello 1995; Gruen et al. 2002; Eavshick and Ory 2003; McKenzie et al. 2003; Hoelscher et al. 2004; Mihalopoulos et al. 2005; Nilsen et al. 2005; Scheirer 2005; Wakerman et al. 2005; Edvardsson et al. 2011; Gloppen et al. 2012; Walsh et al. 2012). In both settings (high-income and low-/middle-income), authors concluded that the sustainability of health programmes requires long-term funding. Studies suggest that chances for sustainability are higher in those organizations that use available funds efficiently (Higgins et al. 2008), regularly assess and plan present and future financial needs (Israel et al. 2006; Casey et al. 2009) and are capable of securing diverse funding streams (Bratt et al. 1998; Eavshick and Ory 2003; Stevens and Peikes 2006). Diversified and sufficient funding in contrast to funding earmarked for a specific intervention was found to improve the chances of sustainability (Rog et al. 2004; Stroul and Manteuffel 2007).

**Ability to adapt, renew or be flexible (‘flexibility/adaptability’).** ‘Flexibility (adaptability)’ has been conceptualized as an attribute of the sustainability of development projects (Bamberger and Cheema 1990; Stefanini and Ruck 1992); innovations in health-care settings (Greenhalgh et al. 2004); and organizations (Olsen 1998; Alexander et al. 2003; Johnson et al. 2004; Mancini and Marek 2004; Pluye et al. 2004a; Hanson et al. 2005; Bowman et al. 2008; Gruen et al. 2008; Humphreys et al. 2008). There are two aspects. The first is the ability to identify and recognize changes in contextual environment, organizational setting, in a health problem or its determinants or in performance. In response, sustainable organizations possess a willingness and ability to change or modify strategy, priorities, or functioning whilst retaining overall organizational mission and performance (Bamberger and Cheema 1990; Olsen 1998; Alexander et al. 2003; Mancini and Marek 2004; Pluye et al. 2004a; Hanson et al. 2005; Gruen et al. 2008; Humphreys et al. 2008). The second aspect is the capability of stakeholders to value, learn, assimilate and apply new knowledge (Olsen 1998; Greenhalgh et al. 2004; Johnson et al. 2004; Pluye et al. 2004a; Gruen et al. 2008; May and Finch 2009; Slaghuis et al. 2011).

Several studies concluded that continuous adaptation to societal changes, community needs and population demands is a driving factor of sustainability (Wakerman et al. 2005; Nordqvist et al. 2009; Greenhalgh et al. 2012; Van Acker et al. 2012). Important for sustainability of organizations was the flexibility to change the organization’s strategy or operations in response to changes in the regulatory or fiscal environment (Bratt et al. 1998; Jana et al. 2004; Israel et al. 2006; Ploch et al. 2006; Wright 2009; Singh et al. 2010; Buykx et al. 2012). These included, for example in the case of funding cuts, redefining services and staffing patterns or changing strategies for creating demand for services (LaPelle et al. 2006). Organizations with cultures open to new knowledge and with emphasis on a high level of proficiency were more likely to sustain innovations (Glisson et al. 2008).

**Capability to build relationships and interactions inside and outside an organization (‘interactions’).** ‘Interactions’ are included as a determinant of sustainability in several frameworks. Definitions of what these relationships imply differed and are often vague. For interventions, these relations were defined as their integration into domestic or routine administrative structures and functions (Bossett 1990; Goodman et al. 1993; Shediac-Rizzkallah and Bone 1998). Others defined interactions as building a broad political support base from the government or influential stakeholders (Bamberger and Cheema 1990; Alexander et al. 2003; Mancini and Marek 2004). In community-based research, interactions were referred to as linkages and support from community members (Alexander et al. 2003; Mancini and Marek 2004; Sarriot et al. 2004; Nelson et al. 2007; Bowman et al. 2008). Some authors outline how interactions likely influence sustainability. Co-ordination or collaboration with various stakeholders was defined as important for effective implementation of health interventions (Bossett 1990; Greenhalgh et al. 2004; Johnson et al. 2004; Mancini and Marek 2004; Sarriot et al. 2004; Scheirer and Dearing 2011), ensuring efficient use of health system resources or resource inputs to an organization (Olsen 1998; Hanson et al. 2005; Gruen et al. 2008; Humphreys et al. 2008).

Relationships within and with other organizations were also found to be a determinant of sustainability in all studies that included this component in the assessment (Supplementary Appendix S3). Pilots or innovations that were not integrated into domestic policy and legal frameworks, formal domestic health services, and ongoing roles and responsibilities were at substantial risk of being discontinued at the end of external support (Bossett 1990; Gruen et al. 2002; Harpham and Few 2002; Fuller et al. 2005; Amazigo et al. 2007; Milne et al. 2007). Collaboration, building alliances, gaining support and involvement of various stakeholders (both political and in the communities) were critical for sustainability in a number of studies (Knippenberg et al. 1997; Bratt et al. 1998; Wong et al. 1998; Eliason 1999; Sivaram and Celentano 2003; Jana et al. 2004; Nilsen et al. 2005; Wakerman et al. 2005; Edwards and Roelofs 2006; Minkler et al. 2006; Jacobs et al. 2007; Nelson et al. 2007; Higgins et al. 2008; Nordqvist et al. 2009; Singh et al. 2010; Greenhalgh et al. 2012). Co-ordination in implementation between actors (e.g. government, NGOs, international actors) was found to be an important determinant for the sustainability of complex health programmes (Mancini and Marek 2004; Greco and Simao 2007; Rosenberg et al. 2008; Le Loup et al. 2010; Torpey et al. 2010).
Ability to bring about results or attain goals (‘performance’).

‘Performance’ is included as an attribute of the sustainability of health programmes (Stefanini and Ruck 1992; Brown 1998; Shiediac-Rizkallah and Bone 1998; Johnson et al. 2004; Pluye et al. 2004a; Sarriot et al. 2004; Stephenson et al. 2004; Nelson et al. 2007; Bowman et al. 2008), institutions (Brinkerhoff and Goldsmith 1992), health services or organizations (Knippenberg et al. 1997; Olsen 1998; Mancini and Marek 2004) and health systems (Berman 1995; Lafond 1995a). This dimension of sustainability was defined as adequate service coverage (Nelson et al. 2007), adequate level of care quality, accessibility, acceptability (Olsen 1998) or performance that encompassed notions of effectiveness, equity and efficiency (Berman 1995; Knippenberg et al. 1997; Olsen 1998).

In empirical studies, achieving results or bringing benefits (either observable or perceived) was found to be an important prerequisite of sustainability of a programme or an organization (Bossert 1990; Streefland 1995; Rashed et al. 1997; Kachur et al. 1999; Scheirer 2005; Amazigo et al. 2007; Jacobs et al. 2007; Toledo Romani et al. 2007; Wang et al. 2008). In a number of studies, the strategic use of monitoring and evaluations systems in planning, refining operations and disseminating results have been particularly important for building credibility and reputation, gaining political and financial support, and consequently sustainability (Knippenberg et al. 1997; Alexander et al. 2003; Eavashwick and Ory 2003; Fuller et al. 2005; Minkler et al. 2006; Stevens and Peikkes 2006; Milne et al. 2007; Nelson et al. 2007; Stroul and Manteuffel 2007; Torpey et al. 2010; Parand et al. 2012).

Role of health system and broader environment in programmatic sustainability.

Contextual factors as determinants of sustainability were included in most frameworks. Among components of contextual environments included in the frameworks are broad political, socio-cultural and economic factors (Bossert 1990; Olsen 1998; Greenhalgh et al. 2004; Mancini and Marek 2004; Sarriot et al. 2004), including the concept of human development (Sarriot et al. 2004). We did not identify any frameworks for sustainability in health system (i.e. interventions, programmes, organizations) that build on explicitly outlined health system conceptualizations. Notably, Blanchet and Girois (2013) proposed a methodological approach to allow context-sensitive conceptualization and measurement sustainability of health systems. The approach uses participatory methods, involving stakeholders in defining sustainability indicators. Only a few authors included the prevailing health system’s characteristics into their frameworks. These were, for example, financial resources available for health, or social and health-care financial mechanisms (Olsen 1998; Mancini and Marek 2004; Hanson et al. 2005); regulatory and legislative base (Greenhalgh et al. 2004; Nelson et al. 2007; Humphreys et al. 2008) or organizational arrangements of the health system (Olsen 1998).

A number of empirical studies concluded that the overarching health system characteristics, economic conditions, political climate, policies of funding agencies and country’s history may influence the sustainability of health interventions or organizations (Amazigo et al. 2002; Dasgupta and Priya 2002; Atun et al. 2005; Sibthorpe et al. 2005; Israr and Islam 2006; Jacobs et al. 2007; Nelson et al. 2007; Stroul and Manteuffel 2007; Williams et al. 2007; Higgins et al. 2008; Humphreys et al. 2008; Rosenberg et al. 2008; Le Loup et al. 2009; Nordqvist et al. 2009; Ashwell and Barclay 2010; Druss et al. 2011). Among external factors, several studies pointed out a key role of donors’ investment policies. This was shown to be important in both high-income and low-middle-income settings. In a low- and middle-income context, investment strategies that support vertical programmes and ‘value for money’ may draw attention away from a unified strategy for health sector development, thus compromising sustainability of the health system (Lafond 1995a). Furthermore, uncertainty in funding negatively affects relations in complex organizations, creating tensions for sharing/competing for resources (Stroul and Manteuffel 2007). Inflexibility of donor funding and project implementation policies was found to be an impediment to sustainability (Wakerman et al. 2005; Israel et al. 2006; Ashwell and Barclay 2010; Humphries et al. 2010).

Sustainability of a communicable disease programme: proposed conceptual and analytical approach

Our perspective on sustainability draws upon theoretical insights of complex adaptive systems that view a system’s resilience as a critically important element of sustainability (Fiksel 2003; Kemp et al. 2005; Fiksel 2006; Folke 2006). We define a sustainable communicable disease programme as continuously effective in reducing a disease problem, and responsive and adaptive to changes in the nature of disease epidemics (actual or perceived), population needs or contextual environment. In this definition, the ‘what’ of sustainability (i.e. what should be sustained) is a continued reduction of a disease problem, and responsiveness to changes in the nature of disease epidemics (actual or perceived), population needs or contextual environment. In this definition, the ‘what’ of sustainability (i.e. what should be sustained) is a continued reduction of a communicable disease problem, which includes interruption of infection transmission and reduction of morbidity and mortality associated with an infection or disease.

Figure 1 offers a representation of the framework for analysis of a programme’s sustainability (i.e. a potential for sustainability). ‘Health systems’ are viewed as complex adaptive systems (Checkland 1981; Plsek and Greenhalgh 2001). ‘Disease control programmes’ are components of health systems. ‘Health system and disease programmes’ comprise a set of critical interacting functions that include governance, financing, planning, service delivery and evaluation and are designed to achieve specific objectives (Atun and Menabde 2008). Fundamental goals of the health system are increased health, protection from financial risk and responsiveness to users (Frenk 1994; WHO 2000; Hsiao 2003), while intermediate goals include equity, efficiency, choice and effectiveness (Atun and Menabde 2008). ‘Health systems’ and ‘disease control programmes’ are embedded within a broader context. ‘The context’ denotes economic, political, regulatory, social-cultural (including historical legacy), epidemiological, regulatory and technological environments (i.e. systems), within which a health system operates and interact with (Atun et al. 2004; Atun and Menabde 2008).

‘Programmes’ are comprised of all organizations and individuals, whose purpose and activities are principally directed
towards the prevention and control of a defined ‘disease problem’. Our analytical framework emphasizes a key role of ‘actors’ and relations among them in establishing, changing and sustaining health programmes. ‘Actors’ may be funders, policy makers, managers, community leaders, groups voicing the needs of patients and users of services, providers of services, professional associations, religious authorities, civil society organizations and other groups who are directly or indirectly affected by a health problem (Gruen et al. 2008; Atun et al. 2010). ‘Intervention’ refers to a programme’s components aimed at control of ‘disease problem’ through service delivery or public health action (e.g. diagnosis, vaccination, treatment). ‘A disease problem’ refers to the nature of an infection or disease caused by a pathogen, character of transmission and scope and magnitude of an epidemic. A disease problem also relates to its changes such as emergence of drug resistance or co-epidemics with other health conditions.

We propose that leadership, capacity, adaptability/flexibility, interactions and performance are the ‘programme characteristics’ (capabilities) that may explain the potential for sustainability (i.e. precursors for sustainability). Proposed definitions for each characteristic are presented in Table 4. The notion of integration (which we have chosen to call ‘interactions’) is one of the conditions necessary for sustainability. Our conception of integration builds on Shigayeva et al. (2010).

Whether proposed precursors for sustainability exist, act and affect the delivery of interventions and consequently contribute to the reduction of a disease problem depend on several factors, including the interrelationships among them. These factors are the nature of the disease problem, interrelationships among ‘actors’ and their institutional roles and interests, structural and functional arrangements of a ‘health system’ and ‘disease control programme’, and ‘context’. Historical paths of health system, disease control programmes and disease itself may play
an important role in determining the programme’s leadership, capacity (i.e. dedicated resources), flexibility, interactions and performance. Additionally, the proposed framework suggests that political and economic environments, institutional interests of actors and health system’s arrangements may directly affect the existence and functioning of a disease control programme, choice and continuous implementation of interventions. Consequently, the aforementioned programmatic factors may influence the scale and actions of interventions on a disease problem, leading (or not) to a reduction of disease incidence or associated mortality and morbidity (i.e. ‘outcomes’).

**Limitations of the proposed framework**

The framework presented in this article is an initial ‘programme theory’, which may need to be refined through additional theoretical specifications and/or through empirical studies. A framework approach to studying complex social systems has its limitations as frameworks include selective constructs, putting emphasis on some information and minimizing the other (Coker et al. 2010). We particularly focused on formal structural and functional arrangements of health systems. The framework does not fully address ‘informal’ interactions and relations between providers and patients, national and international policy makers and others. Informal interactions, on the other hand, indeed may play one of the key roles in the evolvement of complex social systems (Atkinson 2002; Gilson 2003; Gilson 2006; McPake et al. 2006; Schneider et al. 2008; Blanchet and James 2011). In future developments of constructs such as ‘flexibility’ and ‘interactions’, there is a need to incorporate theoretical perspectives from sociology, organizational learning and organizational psychology, including theories explaining dynamics within interests groups such as neo-institutional theory.

Participatory research approaches that engage stakeholders could be used in refining programme theories on sustainability, as recently proposed (Blanchet and Girois 2013; Schell et al. 2013). Empirical studies are required to inform understanding of the relative importance of each proposed precursor to sustainability, which likely differ in different contexts and/or may influence each other in complex ways. Research is needed to gain insights on the relative importance of each level of interaction (i.e. linkages, co-ordination or full integration) (Shigayeva et al. 2010) in ensuring sustainable outcomes. Another important aspect that we did not address was the dynamics of biological systems. Studies on the sustainability of communicable diseases programmes may be extended through methodologies to encompass dynamic relations in biological and human systems such as non-equilibrium statistics, network analysis, agent-based modelling or scenario modelling (Ajelli et al. 2010; Blanchet and James 2011).

We relied on published literature for proposing programmatic characteristics that may explain sustainability. Literature review approach has inherent limitations. Some publications may have been missed due to search limits. As other authors (Scheirer et al. 2010), we found that the empirical evidence base on sustainability in health systems is emerging. This particularly concerns the limited application of theoretical or conceptual models in empirical studies on sustainability.

**Conclusion**

In this review, we aimed to clarify the conceptual understanding of what constitutes sustainability and the link between
notions of sustainability and integration. Despite limitations, our proposal is rooted in explicit theoretical foundation. Though our research is focused on communicable diseases control, our proposal could be applied to other public health problems. Our contribution to the development of theories explaining programmatic sustainability highlights the suggestion that integration of a programme with other health system components is likely one, but not the only, determinant of a programme’s sustainability. Though integration of elements of a programme with other system components is important, its role in sustainability is context specific and difficult to predict. Given the very substantial sums being invested in Global Health Initiatives, we believe that the conceptualization and analysis of programme sustainability are a critically important issue to support funding decisions as well as ensure lesson learning and knowledge dissemination of best programmatic practices.

Authors’ contributions
All authors were involved in critical revision of the manuscript and read and approved the final manuscript.

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Supplementary Data
Supplementary data are available at HEAPOL online.

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