

# Pneumonia market landscape analysis in the Democratic Republic of the Congo (DRC)

Improving access to high-quality  
pneumonia products and services for  
children under the age of five

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## Abbreviations

AMR	antimicrobial resistance
ARI	acute respiratory infection
CDR	a network of regional distribution centers
DFID	Department for International Development
DHS	Demographic Health Survey
DPS	Provincial Division of Health
DRC	Democratic Republic of the Congo
EPI	Expanded Program on Immunization
FEDECAME	Central Federation for the Supply of Drugs
GBP	British pound sterling
GDP	gross domestic product
GHSC TA	Global Health Supply Chain Technical Assistant
Hib	<i>Haemophilus influenzae</i> type b
HMIS	health management information system
IBTC	International Business & Technical Consultants
IBTCI	International Business & Technical Consultants, Inc
IHME	Institute for Health Metrics and Evaluation
NGO	nongovernmental organization
MCSP	Maternal and Child Survival Program
MICS	Multiple Indicator Cluster Survey
MOH	Ministry of Health
PCIMNE	Integrated Community Program on Newborn and Child Diseases
PCV13	pneumococcal conjugate vaccine 13
PEV	Expanded Vaccine Program
PNIRA	National Program for the Control of Acute Respiratory Infections

PROSANIplus	Le Projet de Santé Intégré plus
SARA	Service Availability and Readiness Assessment
SCI	Save the Children International
USD	United States dollar
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

## Executive summary

The Democratic Republic of the Congo (DRC) ranks third in the world for pneumonia deaths in children under the age of five, causing approximately 29,500, or 11.5 percent, of all deaths for this age group in 2016.<sup>1</sup> Proven methods exist to reduce the pneumonia burden, but access to many of the products and services in the DRC is limited. To understand the barriers to access, PATH collected and analyzed secondary data, conducted a landscape of key pneumonia stakeholders in the DRC, and interviewed 35 stakeholders within the government, nongovernmental organizations (NGOs), and the private sector in Kinshasa and Kasai-Oriental provinces, over a four-month period. This report summarizing our findings is intended to improve access to high-quality pneumonia care in children under the age of five (“children” in this report refers to children under five).

Three key factors are required to expand access to high-quality pneumonia care: (1) increasing appropriate care-seeking behavior, (2) improving health care providers’ ability to correctly diagnose pneumonia, and (3) strengthening procurement and supply of high-priority medicines including oxygen. For each, we identify existing barriers and potential sources of market inefficiency.

**1. *Increasing appropriate care-seeking behavior.*** Seeking care for pneumonia requires that a caregiver (family member or other helper that takes care of the ill) has knowledge of the symptoms, has confidence in the quality of the care, and can pay any costs related to the care. The DRC ranks in the bottom quintile of all low- and middle-income countries for care-seeking behavior, with only 43 percent of children with suspected pneumonia being taken to a health facility.<sup>2</sup> However, 65 percent of children with suspected pneumonia are taken for care if seeking care from private pharmacies, traditional practitioners, churches, friends, and other providers with minimal or no formal medical training is included with health facilities.<sup>3</sup> One study found that less than 30 percent of caregivers in the DRC had knowledge of pneumonia symptoms.<sup>4</sup> In addition, the DRC’s public health service has high absenteeism and stockouts of key health products, potentially reducing caregivers’ confidence in the system.<sup>5</sup> Self-medication among end users at pharmacies was commonly reported by health care providers in PATH interviews, perhaps in response to the weak health system.

Even when caregivers recognize the problem and have confidence that the health system will provide high quality care, they must also be able to afford the service. Extreme poverty in the DRC is widespread, with 77 percent of the population living on less than \$1.90 USD per day.<sup>6</sup> Studies have shown that user fees can reduce demand for some health services. Our team observed fees (including for drugs and services) from a median of \$8.50 to \$40 USD for simple and severe pneumonia respectively.<sup>i</sup> Even in cases where medical consultations and drugs were subsidized, travel and opportunity expenses such as lost wages could present insurmountable financial barriers for families.

**2. *Improving the ability of health care providers to correctly diagnose pneumonia.*** Appropriate care depends on trained health workers that correctly diagnose pneumonia and prescribe appropriate treatment.

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<sup>i</sup> Question asked: “What is the total cost of simple (or severe) pneumonia treatment?”

A third of health care providers interviewed failed to mention the presence of fast breathing<sup>ii</sup> when asked to describe the signs and symptoms of pneumonia. During a PATH interview, the DRC Ministry of Health (MOH) noted that “counting respiratory rate is a problem” resulting from inadequate training of health care providers.<sup>iii</sup> Although our study could not assess the quality of training, 40 percent of providers had never received training.<sup>iv</sup> In addition, none of the providers interviewed had a physical copy of pneumonia guidelines on hand. MOH officials blamed budget and logistical constraints for the inadequate distribution of guidelines. Despite challenges in diagnosing pneumonia patients, providers were aware that amoxicillin (either syrup or dispersible tablets) was a suitable treatment for children.

**3. *Strengthening procurement and supply of essential medicines.*** The DRC has separate supply chains for medicines that serve the public sector, private sector, and donor/NGO sector. These redundant supply chains contribute to higher product prices, over- and under-stocking of medicines, and different quality standards for the public and private sectors. Half of health care providers in our work spontaneously mentioned stockouts as a key barrier for pneumonia management.<sup>v</sup> Despite this finding, 10 of the 11 health facilities had some type of pneumonia antibiotics on hand. Amoxicillin dispersible tablets, the recommended treatment by the World Health Organization (WHO) for pneumonia in children under five, were observed in only 60 percent of facilities.<sup>vi</sup> Oxygen therapy to treat pneumonia is entirely lacking from all but the highest-level hospitals. Some NGOs and aid organizations, including the United States Agency for International Development (USAID), do not utilize the national supply chain but have created their own parallel system managed through private contractors. This is partly because public storage and shipping procedures do not meet donor standards in many parts of the DRC. The three supply structures procure products separately, reducing the opportunity for volume discounts. Interviewed stakeholders reported that drug prices in the public sector are higher than in the private sector. This has led public health administrators to purchase drugs directly from the private market despite uncertainty about their quality. Lastly, accurately estimating the size of orders is complicated by poor coordination between the public, private, and donor/NGOs sectors, leading to stockouts, over-purchasing, and wastage.

Opportunities exist to expand access to high-quality pneumonia care. First, given the multiple factors contributing to low care-seeking behavior, we recommend interviews with caregivers to develop context-specific strategies to address caregiver constraints. Second, improving diagnosis will require more health care provider training, potentially using more innovative communication and education methods. Education programs should include training on antimicrobial resistance (AMR). A pilot education program, in partnership with the MOH and local government, should be considered in select provinces in the DRC. Third, better coordination of the currently fragmented supply chain could lead to better availability and lower costs of high-priority drugs. Analyzing the availability of pneumonia medicines

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<sup>ii</sup> Key component of the World Health Organization pneumonia diagnosis criteria.

<sup>iii</sup> Question asked: “Are there any additional barriers specifically pertinent to diagnosing pneumonia?”

<sup>iv</sup> Question asked: “If ever, when is the last time you have received training on diagnosing and treating pneumonia?”

<sup>v</sup> Question asked: “What are some of the largest barriers to providing pneumonia curative services?”

<sup>vi</sup> Question asked: “Do you have drugs or other medicines used for treatment of pneumonia at this facility? If yes, can I see them?”

more systematically, identifying root causes for lack of availability, and proposing appropriate interventions would be beneficial. In addition, digital tools may hold potential in the DRC by compensating for the poor state of roads and infrastructure and by reducing the reliance on traditional paper-based stock management tools.

While a much simpler intervention than pneumonia diagnosis and treatment, the relatively high coverage rate of the pneumococcal conjugate vaccine (75 percent of children receive all three recommended doses)<sup>7</sup> highlights how access to an intervention in the DRC could be improved with adequate investment. The immunization program—which provides vaccines free of charge—has attained a high level of coverage; has simple, clear guidelines for health providers; and has a single, functioning supply chain. This program provides useful insights into what is possible in this complex low-resource country.

## Introduction

PATH conducted a market landscape analysis in the DRC to understand gaps and opportunities for improving access to high-quality pneumonia products and services for children under the age of five. The work focused in the Kinshasa and Kasai-Oriental provinces in the DRC and was conducted between December 2017 and March 2018. The DRC was selected for this work due to the relatively high burden of disease. In addition, the two provinces have different urbanization contexts. Kinshasa is a megacity with more than 11 million people and approximately 80 percent of people living in urban areas, while Kasai-Oriental is more rural with only 35 percent of the population living in urban areas.<sup>8</sup>

The team focused on the below five key project objectives. PATH collected and analyzed secondary data, conducted a literature review, and interviewed 35 stakeholders within the government, NGOs, and the private sector in Kinshasa and Kasai-Oriental provinces (see Appendix 1 for a list of organizations) to gain information on each objective.

- 1) Stakeholder identification: Government, NGO, and health care providers identified and interviewed.
- 2) Pneumonia disease burden: Incidence and mortality of pneumonia in children under the age of five reported.
- 3) Health system analysis: National, intermediate, and operational levels described and key financing for the different levels detailed.
- 4) Pneumonia product landscaping: Availability of prevention, diagnosis, and treatment products and services captured.
- 5) Continuum of care analysis: Barriers and opportunities identified and recommendations generated.

PATH identified three key barriers for improving access to high-quality pneumonia products in services in children under the age of five: (1) low care-seeking behavior, (2) health care providers' ability to correctly diagnose pneumonia, and (3) inefficient procurement and supply of high-priority drugs. The report first describes the burden of disease and the health system, and then it discusses each of the three

key barriers and the supporting evidence for these barriers. Finally, recommendations are made on how to reduce the pneumonia burden of disease in children under five in the DRC.

## Disease burden and unmet need

### Key takeaways

- The DRC ranks third in the world for the number of child pneumonia deaths.
- Pneumonia burden is approximately 3.5 times higher in Kasai-Oriental than Kinshasa.
- Vaccine coverage rates are high but cold chain and administration challenges persist.
- Access to high-quality pneumonia diagnosis and treatments are critical for health impact given that vaccination does not prevent all cases of pneumonia.
- Burden data are often based on lower respiratory infection or acute respiratory infection.

The DRC is well over the Sustainable Development Goals' (SDG) health target for under five mortality (lower than 25 deaths per 1,000 live births by the year 2030). At present, the DRC has an estimated 80.5 deaths per 1,000 live births.<sup>9,vii</sup> The DRC ranks third in the world for pneumonia deaths in children under the age of five, causing approximately 29,500, or 11.5 percent, of all deaths for this age group in 2016.<sup>1</sup> While the mortality rate (deaths per 100,000) has declined over the past 25 years, the absolute number of pneumonia deaths has changed little, likely due to the high population growth rate, which is increasing at 3.3 percent annually (see Figure 1).<sup>10,11</sup>

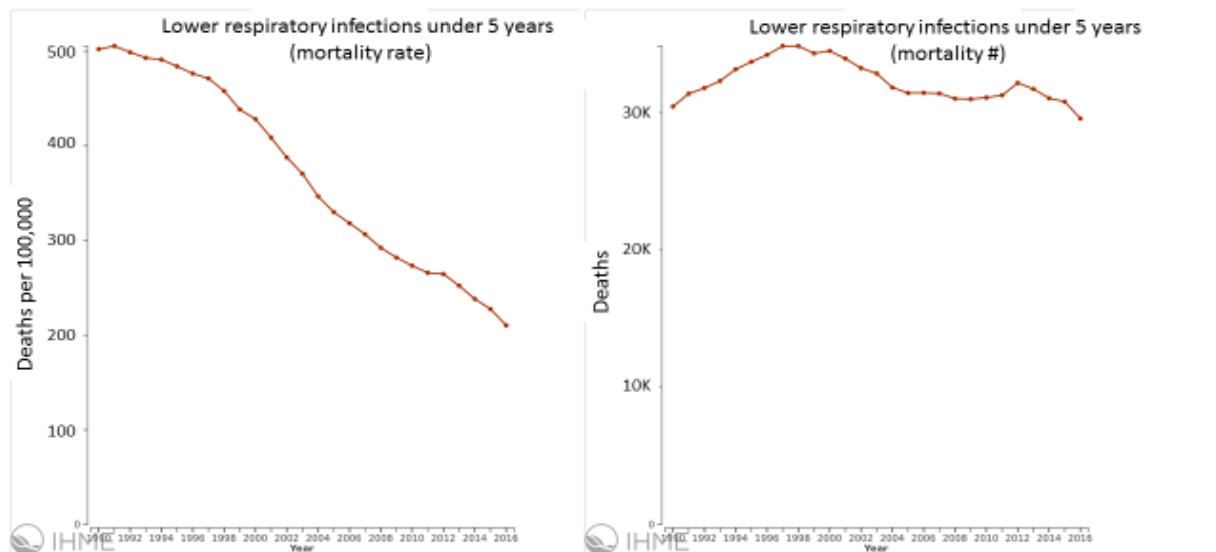
Similar to pneumonia deaths, declines are observed for the incidence rate for pneumonia (number of new cases per 100,000) nationally while the absolute incidence (number of cases) has declined little (see Figure 2), likely due to population growth.<sup>13</sup> The more recent declines in the incidence rates correspond with the launch of vaccines that prevent pneumonia.<sup>12</sup> The *Haemophilus influenzae* type b (Hib) vaccine was launched in the DRC in 2009, and the pneumococcal conjugate vaccine 13 (PCV13) was launched in 2011. Not all cases of pneumonia can be prevented with vaccination. *H. influenzae* and *S. pneumoniae* cause only about 50 percent of pneumonia cases in children.<sup>13</sup> Thus, access to high-quality pneumonia diagnosis and treatments are critical for health impact.

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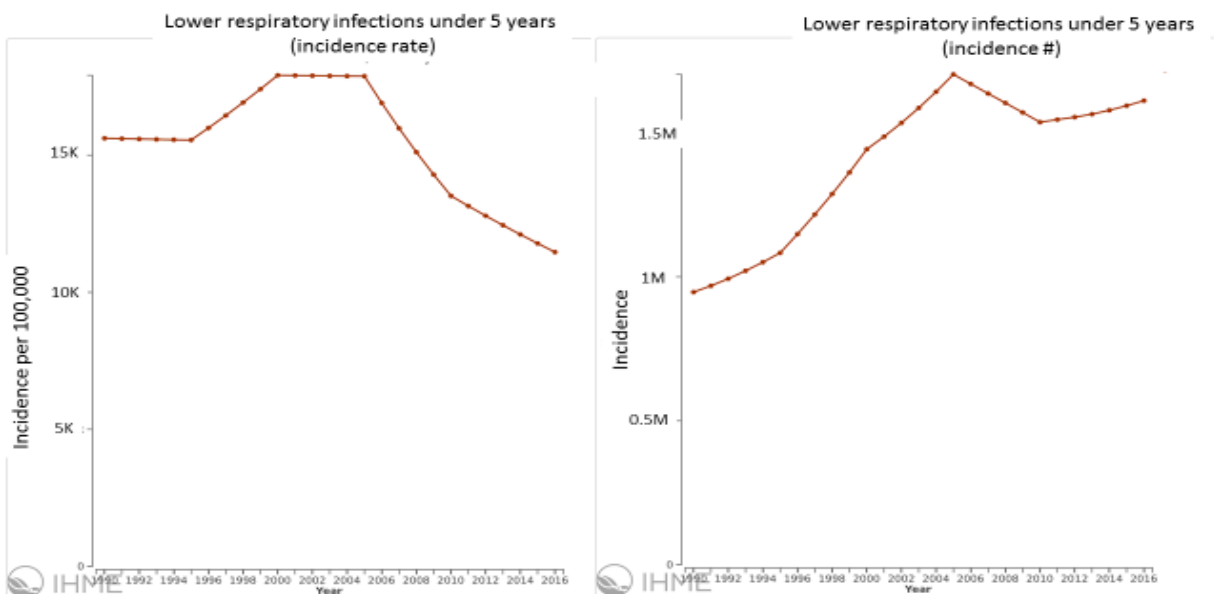
<sup>vii</sup> Other bordering countries' under five mortality rates are 54.5 in Angola, 80.8 in Burundi, 130.5 in the Central African Republic, 49.2 in Rwanda, 93.5 in South Sudan, 55.7 in Tanzania, 62.4 in Uganda, and 59.7 in Zambia.



**Figure 1. National pneumonia mortality based on estimates of lower acute respiratory infection over time.**



**Figure 2. National pneumonia incidence based on estimates of lower respiratory infection over time.**



**The causes of pneumonia in children varies among populations and geographies.** Differences in incidence have been attributed to several factors, including poverty, the environment of the child, underlying conditions (such as HIV infection or malnutrition), vaccination, and genetics.<sup>14,15</sup> Children with malnutrition are at higher risk of both acquiring pneumonia and dying from it.<sup>16</sup> In 2013, an estimated 42.3 percent of children under five were stunted in the DRC,<sup>17</sup> a sign of chronic malnutrition.

Unclean fuel sources and indoor cooking is a known risk factor for pneumonia through directly damaging the lungs and by inducing low birth weight.<sup>18,19,20</sup> Health care providers noted that these cooking methods are common in Kasai-Oriental. The MOH also mentioned that pollution from factories potentially contributed to heightened pneumonia risk in Kinshasa.

The 2013–14 Demographic Health Survey (DHS) reported that 6.7 percent of children under the age of five nationwide were ill with acute respiratory infection, a proxy for pneumonia.<sup>viii</sup> The burden was lower in Kinshasa, with 2.5 percent of children under five being ill, than in Kasai-Oriental, with 8.9 percent of children under five being ill. The DRC national health management information system (HMIS) also found higher pneumonia rates in Kasai-Oriental than in Kinshasa between January 2017 and September 2017 (see Table 1).<sup>ix</sup> These data also distinguish between simple and severe pneumonia. Kinshasa had a higher proportion of pneumonia cases being severe (11 percent) than Kasai-Oriental (6 percent).

**Table 1. Number of simple and severe pneumonia cases in Kinshasa and Kasai-Oriental between January 2017 and September 2017.<sup>21</sup>**

Province	Simple pneumonia	Severe pneumonia	Calculated % of children under 5 with simple and severe pneumonia*
Kasai-Oriental	89,959	5,598	11.7%
Kinshasa	22,383	2,632	2.1%
*Calculations assume 810,000 children under the age of five in Kasai-Oriental and 1,200,000 children under the age of five in Kinshasa. <sup>22</sup>			

**Reported vaccine coverage rates for children are high nationally and in the two focus provinces (see Table 2).** Despite these high coverage rates, Expanded Vaccine Program (PEV) officials reported challenges with proper vaccine cold chain storage and proper training on vaccine administration.

**Table 2. Vaccine coverage rates (for children receiving third dose) by location in 2017.<sup>23</sup>**

	PCV13	Hib containing pentavalent vaccine
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<sup>viii</sup> DHS surveys are nationally representative population based surveys with large sample sizes. The 2013–2014 DRC survey included respondents from 18,171 households.

<sup>ix</sup> HMIS data captures monthly data on services rendered at most health facilities in the DRC. PATH worked with government data technicians and cleaned data internally to ensure accurate reporting.

Nationally	74.6%	77%
Kasai-Oriental province	87%	88%
Kinshasa province	78%	79%

It is important to note that some of the burden data reported in this section are not specific to pneumonia. The DHS and the Institute for Health Metrics and Evaluation (IHME) capture data for acute respiratory infection (ARI) and lower respiratory infections, respectively. The DHS definition for ARI is cough accompanied by short rapid breathing and difficulty breathing as a result of a problem in the chest. Lower respiratory infections include bronchitis and pneumonia. Both ARI and lower respiratory infections are often used as a proxy for pneumonia. The HMIS data reports data collected from health facilities specific to simple pneumonia and severe pneumonia.

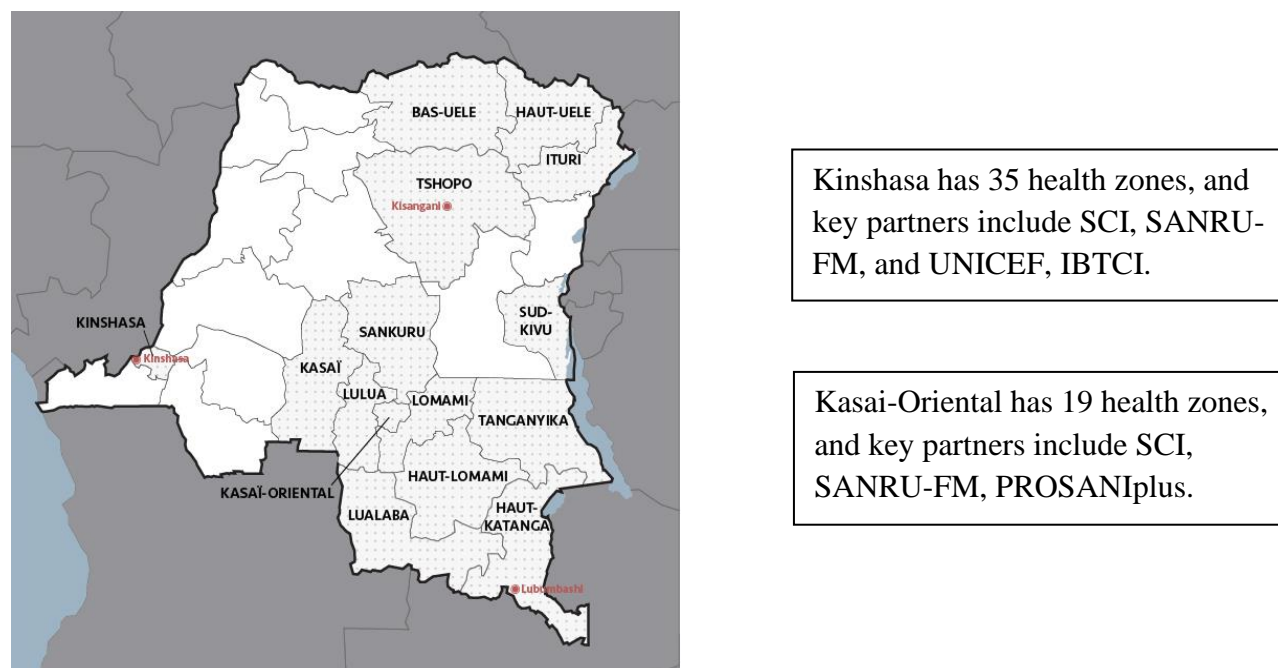
## Health system structure

### Key takeaways

- Three levels of the health system exist: national, intermediate, and operational.
- Intermediate level is divided into health zones.
- NGOs support entire health zones and offer a variety of functions.
- Coordination between government departments managing pneumonia is challenging.

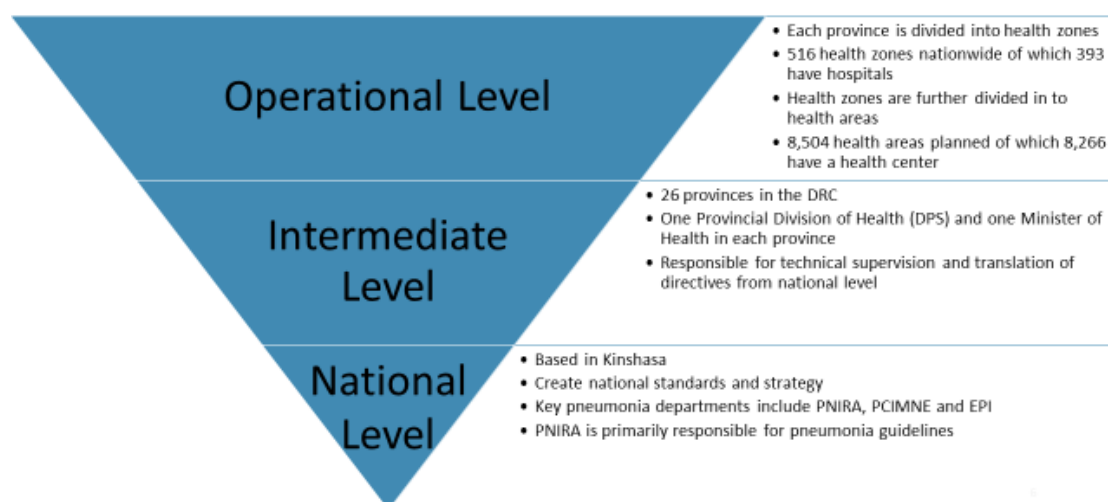
The DRC has 26 provinces (see Figure 3). The capital city, Kinshasa, is a municipal province. The DRC public health system is a tiered structure that comprises three levels: central (national), provincial (intermediate), and peripheral (operational) levels (see Figure 4). Intermediate levels are further divided into health zones. A variety of NGOs and aid organizations support health zones. Our team observed that NGOs help to pay for drugs and equipment, subsidize salaries, offer trainings, and sometimes construct health centers. Work of an NGO tends to cover an entire health zone. Zones with NGO support offer higher standards of care than those unsupported. A list of organizations supporting each province can be found in Appendix 2.

**Figure 3. DRC provincial boundaries and partner donors and NGOs.<sup>x</sup>**



Abbreviations: IBTCI, International Business & Technical Consultants, Inc.; PROSANIplus, Le Projet de Santé Intégré plus; SCI, Save the Children International; UNICEF, United Nations Children's Fund.

**Figure 4. DRC health system overview.**



Abbreviations: DRC, Democratic Republic of the Congo; DPS, Provincial Division of Health; EPI, Expanded Program on Immunization; PNIRA, National Program for the Control of Acute Respiratory Infections; PCIMNE, Integrated Community Program on Newborn and Child Diseases.

<sup>x</sup> Shading for graphic is not specific to this project.

**National level.** National-level structures are based in Kinshasa and define health policy and create national standards and strategy. Headed by the Minister of Public Health, Dr. Oly Ilunga, the Ministry of Public Health is composed of 12 directorates. A General Secretariat coordinates and supervises the directorates in addition to specialized programs. The National Program for the Control of Acute Respiratory Infections (PNIRA) is the key actor for pneumonia control. Other relevant programs are the Integrated Community Program on Newborn and Child Diseases (PCIMNE), which ensures implementation of the WHO Integrated Management of Childhood Illness guidelines and the Expanded Vaccine Program (PEV).<sup>xi</sup>

These various programs create national-level pneumonia treatment guidelines and policy. The Maternal and Child Survival Program (MCSP), a USAID grantee, began work in November 2017 to coordinate the above departments through a working group that convenes quarterly. However, coordination among the large number of departments and ministries that generate policy related to pneumonia remains a challenge.

WHO has developed guidelines for diagnosis and treatment of pneumonia, which countries may choose to adopt (see the “Improving the ability of health care providers to correctly diagnose pneumonia section”). The DRC has adopted the most recent guidelines for treatment, with one exception. The PNIRA definition maintains that a pneumonia with chest indrawing should be considered severe pneumonia. The updated WHO guidelines considers this to be non-severe pneumonia that can be treated with antibiotics in the community if danger signs are not present. PNIRA made this choice due to limited care available at the community level.

**Intermediate level.** The DRC has a decentralized governance structure. Each of the 26 provinces has a Provincial Division of Health (DPS) and a Minister of Health. This level assures a role of technical supervision and translation of directives from the national level to the health zone level. It is also responsible for providing secondary reference health care through the provincial hospital, which is the highest-level referral hospital in a province.

**Operational level.** Every province in DRC is subdivided into health zones, which are further subdivided into health areas. Across all of DRC there are 516 health zones. The current number of health areas was not identified but 8,504 health areas are planned. A health zone is a geographically limited area, headed by a zone Chief Medical Officer, and covers a population between 100,000 to 250,000 inhabitants.

The operational level consists of community care sites, health centers, and hospitals (see Figure 5). Often private and religious facilities work with the public system by referring or accepting referrals of patients. The religious institutions operate many referral hospitals in the DRC. The largest religious network is the

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<sup>xi</sup> Other directorates relevant for pneumonia control activities are the Department of Pharmacy (D3), Directorate for Disease Control (DLM), Directorate of Development of Primary Health Care (D5), Directorate for Development of Primary Health Care, and Directorate of the Health of Family and Specific Groups (D10).

Catholic-based medical system. Additional details on the operational level are found in the “Increasing appropriate care-seeking behavior” section below.

**Figure 5. DRC operational-level pneumonia description.**

			
	Community Care Site	Health Center	Hospital
Health care provider type	Community health worker (unpaid)	Nurse or other trained health provider	Nurses and physicians
Role	Treat simple pneumonia ✓	Treat simple pneumonia ✓	Treat simple pneumonia ✓
	Treat severe pneumonia ✗	Treat severe pneumonia ✗	Treat severe pneumonia ✓
Catchment area	500 households	5,000–15,000 people	100,000–250,000 people
Total facilities in DRC	6,968	8,266	393

## Increasing appropriate care-seeking behavior

### Key takeaways

- Only 43% of children with pneumonia are taken to a health facility.
- Care is also sought from pharmacies, religious organizations, and other individuals with minimal or no formal medical training.
- Care-seeking is constrained by user fees and lack of information.

Seeking care for pneumonia requires that a caregiver (family member or other helper that takes care of the ill) has knowledge of the disease, financial resources to pay for care, and believes that seeking care is a good investment of time and money. The 2013–2014 DHS estimates that only 43 percent of children with suspected pneumonia are taken to a health facility for care.<sup>xii</sup> A study using 2010 Multiple Indicator Cluster Survey (MICS)<sup>xiii</sup> data found a similar proportion (40 percent) of children with suspected

<sup>xii</sup> DHS surveys are nationally representative population based surveys with large sample sizes. The 2013–2014 DRC survey included respondents from 18,171 households.

<sup>xiii</sup> The next round of MICS data collection is scheduled to be completed in 2018 (data is not currently available).

pneumonia who were brought to care at an “appropriate” provider.<sup>xiv</sup> In this study, the authors define “appropriate” as accredited by the government to provide care. However, they found that a larger proportion, 65.3 percent, report seeking pneumonia care from any type of provider (“appropriate” and “non-appropriate”). The “non-appropriate providers” include private pharmacies, traditional practitioners, churches, friends, and other providers with minimal or no formal medical training (see Table 3).<sup>3</sup>

**Table 3. Care seeking by facility and/or provider type.**

Facility type	% among those seeking care <sup>xv</sup>	Provider type <sup>xvi</sup>	“Appropriate” or “non-appropriate” <sup>xvii</sup>
Hospital	12	Physician and nurse	Appropriate
Health center	30	Nurse or other trained health provider	Appropriate
Community care site	3	Community health worker (unpaid volunteer)	Appropriate
Unidentified other	11	Non-specified medical providers	Appropriate
Private pharmacy	18	Pharmacist, nurse, or untrained worker	Non-appropriate
Traditional practitioner	6	Traditionally trained provider	Non-appropriate
Other	20	Church, friends, and vendors	Non-appropriate

**Costs of service are variable and financial constraints likely present barriers for those seeking health services.** PATH interviews observed fees (including for drugs and services) from a median of \$8.50 to \$40 USD for simple and severe pneumonia, respectively. Fees for simple pneumonia ranged from a low of \$0 at a Save the Children supported community care site to \$20 at a hospital. Health centers charged lower fees than hospitals—between \$2 and \$7 at the three health centers PATH visited (See Appendix 4).<sup>xviii</sup> Fees for severe pneumonia ranged from a low of \$20 to \$50 at hospitals. User fees are common in low-income settings to fund health services.<sup>24</sup> Caregivers must decide whether to incur a

<sup>xiv</sup> The MICS survey had a sample of 11,093 children in the DRC with more than 700 having suspected pneumonia.

<sup>xv</sup> This column shows the share of care sought at various facility types only among the 65.3 percent of people that seek care for pneumonia in the DRC. In cases where children were taken to more than one provider, each visit is included separately. Data are drawn from MICS and analyzed by Noordam et al 2015.

<sup>xvi</sup> Provider types are from PATH observations and/or from descriptions in Noordam et al 2015. Level of education and training for each provider type was not provided.

<sup>xvii</sup> Noordam et al 2015 classifies facilities as “appropriate” or “non-appropriate” (see definition above).

<sup>xviii</sup> Question asked: “What is the total cost of simple (or severe) pneumonia treatment?”

financial burden to seek care. Given that more than three-quarters of families in the DRC live on under \$1.90 day,<sup>6</sup> the total cost of treatment including transport fees and lost wages is high. High costs of health care, lack of health insurance or credit, and extensive poverty suggest that health care costs may inhibit care seeking.<sup>xix</sup>

**Information coupled with lower prices may help increase demand for health services.** Potential care-seekers may need more information on the benefits and availability of health services. Several studies highlight the importance of coupling information with price reductions to increase demand.<sup>25,26</sup> A recent study in the Haut-Katanga province of the DRC shows demand for health services decreased after a reduction prices.<sup>5</sup> In this study, the authors suggest that if the price reductions had been combined with information on the value of the health service, it may have increased care-seeking.

While PATH did not interview caregivers for this report, there is information to suggest that caregivers lack knowledge of the symptoms of pneumonia. One study evaluated knowledge of pneumonia symptoms measured by fast and/or difficulty breathing in the DRC. In this study of more than 7,000 caregivers, less than 30 percent mentioned difficulty or fast breathing as being associated with pneumonia.<sup>4</sup> Increasing awareness of pneumonia symptoms and the value of treatment could potentially increase care-seeking.

**Incomes are low, employment is irregular, and credit is lacking.** When a child becomes ill, many of the 77 percent of families in the DRC that make \$1.90 per day may have little or no money to pay for treatment. Stakeholder interviews informed PATH of methods that families use to pay for health care costs. Health facilities sometimes offer a payment plan. A family pays what they can upfront and promises to pay the rest later. In other instances, families borrow from friends and family to find the needed funds. However, bills often go unpaid. As a last resort, families sell their durable assets such as clothing, cell phones, and furniture. More work is needed to understand these informal credit networks through which individuals borrow money from family and community members.

**Low government spending on health in DRC contributes to high cost of services.** The government spent about 1.6 percent of GDP on health care in 2016.<sup>27</sup> Only 10 percent of countries with reported data have a lower health expenditure as a percent of GDP. The bulk of this spending is at the national level and on administration rather than on service delivery.<sup>28</sup> While reducing the cost of health care services is a priority for the DRC Ministry of Health, low government income and expenditure make this a challenge to achieve. Current efforts to reduce cost include subsidizing deliveries and participation in the Global Financing Facility to coordinate donors and achieve economies of scale.

**Donors have a large role in filling gaps.** Donors spend approximately 2.7 times more on health care than the DRC government. In 2015, the DRC government spent \$3 per capita while donors spent \$8 per capita.<sup>29</sup> There is large variation in donors' programs. Some support coordination across government entities and NGOs to increase access to pneumonia products and services. However, the donors more commonly fund an NGO to implement local programs in specific health zones. PATH observed that

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<sup>xix</sup> See Appendix 3 for additional indicators on the DRC fundamentals.



NGOs help to pay for drugs and equipment, subsidize salaries, offer trainings, and sometimes construct health centers. NGO projects tend to cover an entire health zone but stop at the border. This approach has led to a patchwork of coverage, with zones with NGO support offering higher standards of care and those without having substandard services.

## Improving the ability of health care providers to correctly diagnose pneumonia

### Key takeaways

- 30% of providers interviewed failed to mention fast breathing as a symptom of pneumonia.
- Few providers received pneumonia training.
- Pneumonia guidelines are not widely disseminated.
- X-ray and laboratory testing capabilities are limited.
- Health care provider compensation may challenge high-quality service provision.

Appropriate care requires that an accurate diagnosis is made and the proper treatment for that diagnosis is provided. In the case of a positive pneumonia diagnosis, a patient requires antibiotics and potentially supportive care. This section discusses factors that inhibit the delivery of effective care, including adequate training, availability of diagnostic equipment, and health worker motivation. Drug availability will be addressed in the “Supply system for medicines” section.

**Pneumonia training.** Approximately forty percent of health care providers interviewed had never received pneumonia training (see Appendix 4 for additional details).<sup>xx</sup> Only one hospital visited, a private religious facility in Kinshasa, had regular in-house trainings for pneumonia. Pneumonia guidelines have been developed by PNIRA, but none of facilities we visited had guidelines on hand. In addition, interviewed PNIRA stakeholders said that budget constraints limit guideline dissemination. Community health care providers, not supported by an NGO, had also received no training for pneumonia.

**Diagnosing pneumonia.** Thirty percent of stakeholders interviewed did not spontaneously mention fast breathing as a symptom of pneumonia. Many health care providers cited cough and fever, which are not part of the WHO classification of pneumonia (see Figure 6 and Appendix 4).<sup>xxi</sup> Counting breathing can be done by eye and with a watch or timer. Respiratory rate counters may help community health care providers or those with less training to accurately count breaths. Some NGO and MOH officials stated that accurately counting breaths is “problematic.”<sup>xxii</sup> However, in our field visits, health care providers

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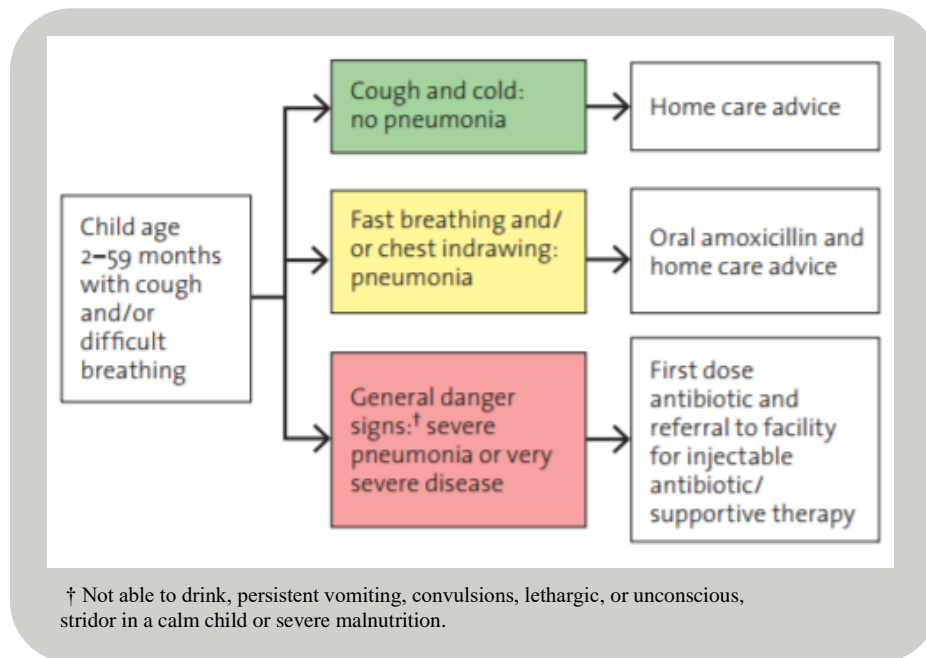
<sup>xx</sup> Question asked: “If ever, when is the last time you have received training on diagnosing and treating pneumonia?”

<sup>xxi</sup> Question asked: “What are the clinical signs used in the assessment of children with possible pneumonia?”

<sup>xxii</sup> Health care providers who knew that fast breathing is a symptom of pneumonia reported that counting breaths is not problematic.

were aware that amoxicillin (either syrup or dispersible tablets) was a suitable treatment for simple pneumonia in children.

**Figure 6. WHO pneumonia classification and treatment.**<sup>30</sup>



**X-rays and laboratory tests can be helpful tools for diagnosing pneumonia.** PATH observed few functional x-ray machines in health care facility visits. Stakeholders mentioned equipment failure, electricity outages, and mistakes in interpretation of x-rays as challenges in aiding in diagnosis. Laboratory equipment to identify the bacteria or virus causing a pneumonia can be helpful in severe cases for choosing the best medicine. Many of facilities that PATH observed had a laboratory but lacked tools and reagents for culturing samples and determining the pathogen causing the patient’s pneumonia.

**Other considerations related to service provision.** Only one in four public health care providers in DRC receive a salary.<sup>30</sup> Often health care providers are paid through user fees. A variety of approaches have been tried to increase health care provider motivation and quality service delivery. The most common one identified is pay for performance mechanisms that tie a health zone funding to measurable outputs. Despite positive feedback from health zone administrators in this work, these approaches have failed in a randomized controlled trial to generate impact.<sup>5</sup> Community health care providers are unpaid volunteers that work approximately three hours daily. Three were interviewed in our work. They report doing their work “for the love of the community.” Stakeholders mentioned that ensuring they are sufficiently compensated to succeed in their jobs is essential. Other research has found that intrinsic

motivation can be leveraged to select community health care providers but compensation is still needed for long-term sustainability.<sup>31,xxiii</sup>

## Strengthening procurement and supply of essential medicines

### Key takeaways

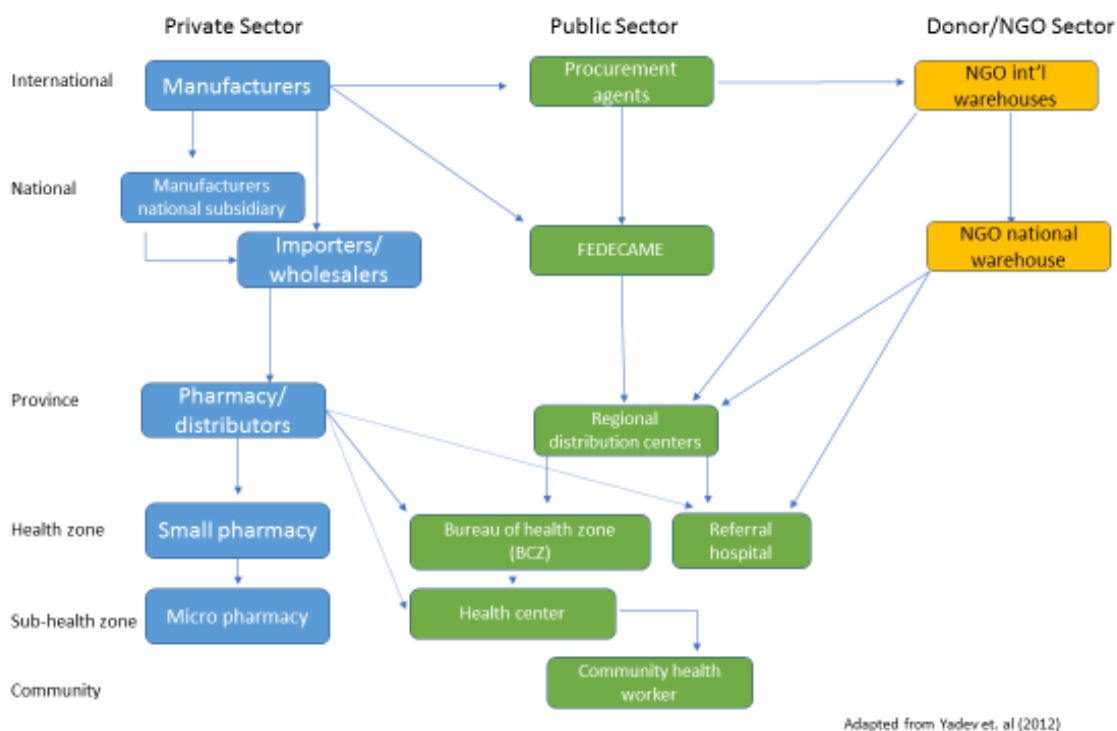
- Separate supply chains exist for the public, private, and donor/NGO sectors.
- The private sector is the least expensive but quality of medicines is unknown.
- Better coordination is needed for the different supply chains to improve efficiency.
- Drug stockouts are frequently reported and some essential medicines are lacking.

DRC has separate supply chains for medicines that serve the public sector, private sector, and donor/NGO sector (see Figure 7). These redundant supply chains contribute to higher product prices, over- and under-stocking of medicines, and different quality standards for the public and private sector. Each supply chain has individual incentives to maintain the status quo and requires coordination, policy change, and investment to improve. In their current state, these inefficiencies may contribute to higher than optimal prices for consumers. Most interviews and data collection for this report come from the public sector. However, background information on the NGO and private-sector supply chains are included for completeness and clarity.

**Figure 7. Three separate health product supply chains in DRC.**

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<sup>xxiii</sup> Intrinsic motivation is defined as engaging in a behavior because it is naturally satisfying to you.



Abbreviations: FEDECAME, Central Federation for the Supply of Drugs; NGO, nongovernmental organization.

**Half of health care providers in our work spontaneously mentioned stockouts as a key barrier for pneumonia management.**<sup>xxiv</sup> While amoxicillin-based drugs were observed at nearly all facilities (10 of 11), the WHO-recommended treatment, amoxicillin dispersible tablets, were only found at 7 of 11 facilities (see Figure 8).<sup>xxv,xxvi</sup> The only facility without any amoxicillin-based drug was a community care site. Amoxicillin syrups and amoxicillin capsules were observed at lower frequencies. Some health care providers in our study mentioned breaking adult formulation capsules and then diluting them in liquid for use in children when syrup or dispersible tablets are not available. These adaptations could compromise administering the appropriate dose. Breaking adult formulations for use in children is also mentioned by the United Nations Children's Fund (UNICEF) as a challenge in treating pneumonia in low-resource settings.<sup>32</sup> In the facilities we visited, gentamicin was the most commonly available drug for severe pneumonia and was present at five of the seven hospitals visited. Oxygen (data not shown) was only available at two hospitals visited. The DRC 2017–2021 Strategic Plan for Integrated Management of Childhood Illness states that oxygen should be stocked at hospitals but not at health centers. The observed antibiotic data was at a single point in time. Longitudinal data were not collected in this work.

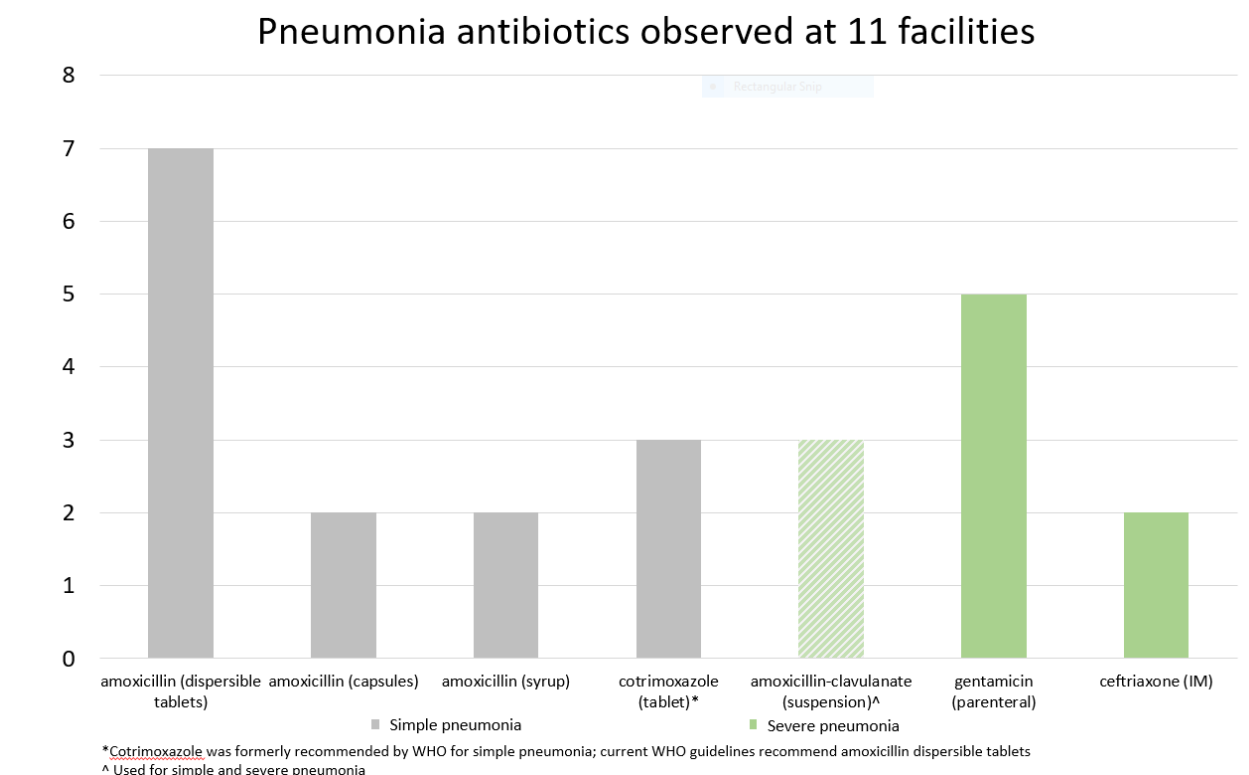
<sup>xxiv</sup> Question asked: "What are some of the largest barriers to providing pneumonia curative services?"

<sup>xxv</sup> Question asked: "Do you have drugs or other medicines used for treatment of pneumonia at this facility? If yes, can I see them?"

<sup>xxvi</sup> Facilities in our sample include hospitals (N=4), health centers (N=5), community care sites (N=1) and pharmacy (N=1).

Longitudinal data could be beneficial for understanding the frequency and duration of drug stockouts mentioned by health care providers.

**Figure 8. Antibiotics observed.**<sup>xxvii</sup>



Availability of amoxicillin 250 mg dispersible tablets and syrups (250 mg/5 ml) was captured in a 2015 sepsis study. This study focused on the South Ubangi, North Ubangi, and South Kivu provinces in the DRC. In their work, 30 percent of health centers and 20 percent of hospitals had amoxicillin dispersible tablets during the time of visit.<sup>33</sup>

In addition, availability of essential medicines, including amoxicillin dispersible tablets, syrups, parenteral gentamicin, and oxygen was assessed in the 2014 Service Availability and Readiness Assessment (SARA) study that was developed by WHO and USAID.<sup>34</sup> SARA is a health facility assessment tool that is designed to assess and monitor the service availability and readiness of the health sector and to generate evidence to support the planning and managing of a health system. Data collection

<sup>xxvii</sup> PATH was not able to review drug availability information at four health facilities.

for this nationally representative survey began in 2012.<sup>xxviii</sup> This project found that 50 percent of health facilities had amoxicillin dispersible tablets, syrup or suspension nationally. Parenteral gentamicin was available at 12 percent of health facilities. Lastly, oxygen was available at 5 percent of hospitals offering surgical services.

**The public sector is headed by a federation of regional distribution centers (FEDECAME).**

FEDECAME is one of three medicine supply chains in DRC supplying medicines. Its mission is to provide a public service and implement pharmaceutical policy at the national level. FEDECAME is an entity independent from the government but that makes orders on behalf of government-managed health facilities. A network of regional distribution centers (CDRs) sends orders to FEDECAME, which then puts out tenders. FEDECAME is externally audited and has contracts with the World Bank, European Union, and USAID.

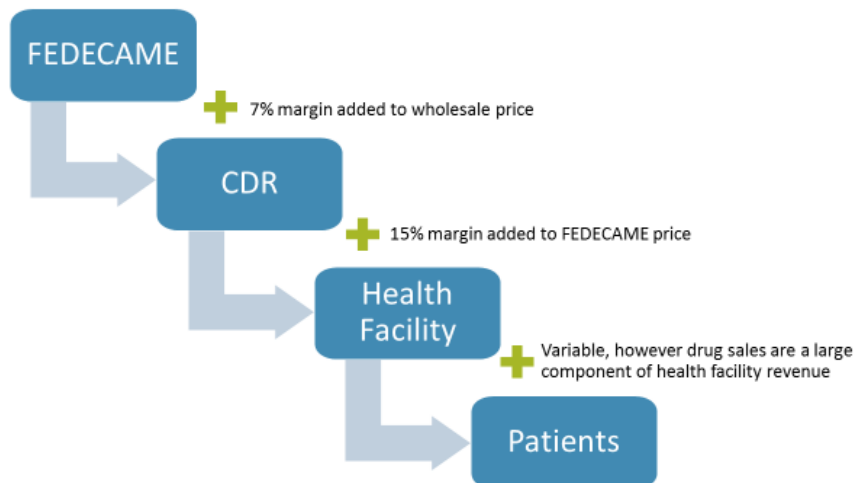
Orders are made through competitive processes using prequalified suppliers. Suppliers are chosen through a public and open prequalification process. Tenders go out once per year, and the lowest bidder wins a tender. Deliveries from abroad are made to DRC twice per year. FEDECAME orders medicines based upon needs of CDRs, which must estimate their consumption for the next year. A CDR pays FEDECAME to buy drugs. Health zones collect consumption data from health facilities and make orders to the CDR. A line of credit is required to order drugs from the CDR.

A system of CDRs make purchases from FEDECAME at a 7 percent markup from wholesale (see Figure 9).<sup>35</sup> CDRs then sell drugs to health zones with an additional 15 percent markup. These margins cover administration, transport, and storage costs. At the facility level, an additional margin is added to drug prices. This provides a small profit for the health facility as well as allows the facility to have cash on hand to buy more drugs.

**Figure 9. Public sector supply chains margins.<sup>36</sup>**

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<sup>xxviii</sup> In the nationally representative sample, 1,555 health facilities were included. Data was collected prior to the 2015 provincial reorganization. Provincial-level data is not provided for this reason.



Abbreviations: CDR, regional distribution center; FEDECAME, Central Federation for the Supply of Drugs.

Some donors and NGOs engage by subsidizing the prices paid by a CDR. Health zones buy drugs from the CDR. However, multiple health zone officials interviewed reported that prices at the CDR are higher than in the private sector. Health zones without funding from donors often buy from the private sector. FEDECAME officials suggested that donor funds could also subsidize or provide technical support for transportation. CDR and FEDECAME officials claim their prices are higher due to the high cost of quality management through supplier selection, storage, and shipment.

Delays occur between when orders are made and delivered. In the interim, health zones procure from the private sector. In addition, facilities move supplies from those with a surplus to those stocked out in between shipments. When shipments arrive to the seaport in Matadi, third-party couriers move medicine by air freight to a FEDECAME warehouse in Kinshasa. From Kinshasa, supplies are shipped again to Kasai-Oriental, adding cost and potentially delays.

**The donor/NGO sector often use their own supply systems.** USAID and its contractors do not use the public procurement system in DRC. Other organizations, including UNICEF, have their own procurement systems. USAID has established the Global Health Supply Chain Technical Assistance (GHSCTA), which has an office in Kinshasa. The GHSCTA currently manages procurement for all USAID-funded projects in DRC. Under this arrangement, the GHSCTA orders, purchases, and imports all drugs for USAID projects and ships them directly to CDRs, its own warehouses, and directly to health zones.

**Private-sector supply is through importers and wholesalers<sup>xxix</sup> based in DRC.** Local pharmacies make orders directly to wholesalers and distributors by phone. A pharmacy in Kasai-Oriental mentioned that orders are filled within two days. The same air-freight considerations in the public system apply to the private sector in Kinshasa. Kasai-Oriental wholesalers tend to operate and import through four hubs—

<sup>xxix</sup> Wholesalers may both import and sell drugs, while importers strictly bring drugs through the port of entry.

Kinshasa airport, Matadi seaport (to deliver to Kinshasa), Lubumbashi (from Southern Africa), and Goma (from East Africa).

Nearly 20 percent of those seeking care for pneumonia go to private pharmacies. Many pharmacies are present in the private sector, generating competition and likely contributing to lower prices than the public sector. The source of lower prices may be lower-quality products, cost-volume efficiencies, and a largely unregulated private sector.

### **Interaction between the supply chains**

FEDECAME and CDRs report that NGOs and donors, such as USAID, UNICEF, and the UK's Department for International Development (DFID), sometimes directly buy drugs and distribute them to health zones. Other NGOs procure medicine and pay CDRs to store and distribute. However, the CDR is not obligated to communicate this transaction to FEDECAME. FEDECAME may have already purchased the same order (without donor funding) and charged the CDR. As a result, the CDR is left with surplus, potential wastage of drugs, and lost revenue.

Duplicate management structures of multiple supply chains increase transaction costs. Importing drugs into the DRC is difficult, slow, and expensive; DRC ranks 188 of 188 on the World Bank's Trading Across Borders Index, a measure that takes into account the time, expense, corruption, and other factors that affect the ability to import goods into a country.<sup>37</sup>

## **Limitations**

There are many limitations to note in this work. This was a rapid assessment occurring over a four-month period between December 2017 and March 2018. The sample size is small. Thirty-five stakeholders were interviewed, including government officials, NGOs, and health care providers (see Appendix 1). The work took place in only 2 out of 26 provinces in the DRC. Broad market data (sales, unit volumes, and prices) are not available on the products assessed. One nationally representative sample on the availability of essential medicines, including pneumonia medicines, was identified. However, data collection for this sample began in 2012 prior to the installment of the new provincial divisions that occurred in 2015. In addition, the study did not break down the availability of drugs by different formulations. Lastly, the burden of disease data reported by DHS and IHME is not specific to pneumonia.

## **Recommendations**

This report identifies increasing appropriate care-seeking behavior, improving diagnosis of pneumonia patients, and strengthening the supply chain as key opportunities for impact. The recommended activities described below are intended to build on our current understanding and to provide initial next steps.



**Increasing appropriate care-seeking behavior.** DRC ranks in the bottom quintile among low- and middle-income countries for pneumonia care seeking. Only 43 percent of children under the age of five with suspected pneumonia are taken to a health facility by a caregiver. However, 65 percent of children with suspected pneumonia are taken for care if seeking care from private pharmacies, traditional practitioners, churches, friends, and other providers with minimal or no formal medical training are included along with health facilities.

Interviews with caregivers, which were not in the scope of this work, are needed to inform strategies for increasing care-seeking behavior. The team identified several factors that may reduce care seeking. First, user fees may limit the ability of many caregivers to seek care at a health facility due to financial constraints. Reported user fees for pneumonia care are high relative to incomes. Second, caregiver awareness of pneumonia symptoms is low. Lastly, frequent drug stockouts and provider absenteeism may potentially deter caregivers from seeking care. Caregiver interviews would help develop context-specific strategies to address caregiver concerns and constraints.

PATH recommends that potential partners consult with the National Program for Combating Acute Respiratory Infections (PNIRA) in Kinshasa on this work. The PNIRA is the key government entity responsible for pneumonia control. It also coordinates and publishes community outreach documents for pneumonia (see Appendix 5). The PNIRA may also be helpful at identifying regions where care seeking is more robust and less robust to provide a more diverse sample. We also recommend connecting with the National Directorate of Family Health, which is responsible for family health promotion programs.

**Improving diagnosis of pneumonia.** Several issues with health care provider training of pneumonia were identified in this work. Pneumonia guidelines were not present in health facilities, pneumonia-specific training was infrequent, and a third of health care providers interviewed did not mention fast breathing as a symptom of pneumonia (fever and cough were frequently mentioned). We recommend piloting a health care provider education program in select provinces in the DRC. Health care provider training could improve diagnosis and increase the number of children receiving the appropriate treatments. The work should include disseminating pneumonia guidelines, identifying ideal modules for training, implementing training modules, and monitoring the impact of the number of individuals diagnosed (pre- and post-training). In addition, education programs should focus on training health care providers to combat antimicrobial resistance (AMR). Misdiagnosis of pneumonia, and misuse of pneumonia drugs, contribute to AMR. WHO states that AMR is an “increasingly serious threat to global public health that requires action across all government sectors and society.”<sup>38</sup> One study estimates that continued rise in resistance by 2050 would lead to 10 million people dying each year globally.<sup>39</sup>

Health care provider training efforts should be done in coordination with the MOH at both the central and provincial levels. Partnering with PNIRA and the Provincial Division of Health (DPS) in provinces of interest will be critical for this work. In addition, the National Pharmacovigilance Center may provide insights on AMR. Pilot findings could be shared to other provinces to leverage impact.

**Strengthening the supply chain to increase availability of pneumonia treatment drugs.** The DRC supply chain is complex, with different supply chains for private, public, and donor/NGO sectors. Our finding from a small in-person survey was that the WHO-recommended antibiotic for pneumonia, amoxicillin dispersible tablets, was available on the day of the visit at approximately 60 percent of health facilities that PATH visited. Perhaps more significantly, half of health care providers interviewed spontaneously mentioned drug stock-outs as a major impediment to pneumonia care. Oxygen is available at only the highest levels of the health system. Interviews with stakeholders involved with the DRC supply chain mentioned that coordination across the supply chains is poor, leading to frequent stockouts and wastage.

Analyzing the availability of pneumonia medicines more systematically, identifying root causes for lack of availability, and proposing appropriate interventions would be beneficial. The sample size in this work is small. Two other studies have been identified that describe the availability of antibiotics in health facilities. The SARA study, which includes a nationally representative sample, began data collection in 2012 and is dated and does not provide information on various formulations of drugs. The other study, focusing on sepsis, evaluated the availability of medicines in 26 facilities in 2015. Expanding access to antibiotics for those in need could have great impact. PATH health impact modeling using the Lives Saved Tool (LiST) found that scaling up oral antibiotics to treat pneumonia by 8 percentage points (from 42 percent peak coverage to 50 percent peak coverage) could save 42,817 children under the age of five by the year 2030 in the DRC.<sup>40</sup> For more information on the Lives Saved Tool, please see Appendix 6.<sup>xxx</sup>

Finally, coordination between supply chains, more accurate forecasting and ordering, and increased efficiency and accountability may be catalyzed using digital solutions for strengthening supply chain management. Digital tools hold potential in the DRC by compensating for the poor state of roads and infrastructure and by reducing the reliance on traditional paper-based stock management tools. The MOH has expressed interest to PATH in implementing OpenLMIS<sup>xxxi</sup> in a new digital health strategy. Partnering with FEDECAM and CAMESKIN and CADMEKO will be important in any efforts to strengthen supply chain efforts.

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<sup>xxx</sup> The baseline LiST model assumes a 42 percent coverage rate over the forecast time frame. PATH assumed a five year time to peak coverage (year 2023) and then held coverage flat (50 percent) for the forecast time frame (ending in 2030). The type of oral antibiotic modeled is not specified. LiST assumes a 70 percent oral antibiotic effectiveness rate for pneumonia in children under the age of five.

<sup>xxxi</sup> OpenLMIS is a powerful, open source, cloud-based electronic logistics management information system (LMIS) purpose-built to manage health commodity supply chains. It is available at <http://openlmis.org/>.

# Appendix 1

## Stakeholder list

Number	Kinshasa Organizations	Stakeholder Type
1	Central Federation for the Supply of Drugs (FEDECAME)	Supply chain
2	Provisional Health Division (DPS)	Government
3	Expanded Vaccine Program (PEV)	Government
4	MOH General Secretariat	Government
5	Kimbondo Pediatric Hospital	Provider
6	Central Division for Distribution of Essential Medicines (CAMESKIN)	Government
7	Dipumba Hospital	Provider
8	Management Sciences for Health	Nonprofit
9	MCSP (USAID)	Nonprofit
10	Kinshasa health zone administration	Government
11	National Pharmacy (D3)	Government
12	National Program for Combating Acute Respiratory Infections	Government
13	St. Joseph Hospital	Provider
14	Galilee community care site	Provider
15	Galilee health center	Provider
16	Global health supply chain technical assistance (USAID)	Supply chain

Number	Kasai-Oriental Organizations	Stakeholder Type
1	Bonzola health zone administration	Government
2	CADMEKO	Supply chain
3	Dipumba Hospital (administrator)	Provider
4	Dipumba Hospital (clinician)	Provider
5	Bonzola Hospital (administrator)	Provider
6	Bonzola Hospital (clinician)	Provider
7	Kansele Hospital	Provider
8	Provincial Health Division	Government
9	DHIS2 data technician	Government
10	Kansele Hospital	Provider
11	Muya Hospital	Provider
12	Focus Group	Mixed group
13	Kasa-vubu Community Care Site	Provider
14	Kasa-vubu Health Center	Provider
15	Lumiere Du Soir Health Center	Provider
16	Kasai-Oriental central government	Government
17	Muya health zone administration	Government
18	ProSani Mbuji-Mayi	Nonprofit
19	Pharmacy	Private

## Appendix 2

### Partners

Province	# Community care sites	Partners
Bas-Uele	129	PMI, ASF / PSI / MCSP, SANRU-FM
Equateur	364	SANRU-FM-UNICEF
Haut-Katanga	335	SANRU-FM, PMI, ASF / PSI, Malaria care
Haut-Lomami	221	SANRU-FM, PROSANIplus-USAID
Haut-Uele	119	SANRU-FM
Ituri	389	SANRU-FM-UNICEF
Kasaï	199	DFID-ASSP-Sanru, SANRU-FM, PROSANIplus-USAID
Kasaï Central	261	PMI, ASF / PSI, SANRU-FM, PROSANIplus-USAID, DFID-ASSP-Sanru
Kasaï Oriental	213	SCI, SANRU-FM, PROSANIplus
Kinshasa	203	SCI, SANRU-FM, UNICEF, IBTCI
Kongo Central	245	SANRU-FM-UNICEF
Kwango	139	SANRU-FM-UNICEF
Kwilu	216	SANRU-FM-UNICEF
Lomami	228	PMI, ASF / PSI, SANRU-FM, PROSANIplus-USAID
Lualaba	108	PROSANIplus-USAID
Mai-Ndombe	176	SANRU-FM-UNICEF
Maniema	147	SANRU-FM
Mongala	213	SANRU-FM-UNICEF
Nord Kivu	98	SANRU-FM
Nord Ubangi	121	SANRU-FM
Sankuru	217	SANRU-FM, PROSANIplus-USAID
Sud Ubangi	518	SANRU-FM-UNICEF
Sud-Kivu	178	PMI, ASF / PSI, SANRU-FM, PROSANIplus-USAID
Tanganyika	1473	CIDA-OMS-IRC, PMI, ASF / PSI, SANRU-FM
Tshopo	289	PMI, ASF / PSI / MCSP, SANRU-FM
Tshuapa	169	SANRU-FM-UNICEF
<b>26 provinces</b>	<b>6968 SSC</b>	<b>Partners</b>

## Appendix 3

Select World Bank indicators				
	1990	2000	2010	2016
Population total (millions)	34.61	47.08	64.52	78.74
Population growth (annual %)	3.4	2.5	3.3	3.3
Life expectancy at birth	49	50	57	59
Mortality rate (under 5 per 1000 live births)	184	160	116	94
Prevalence underweight children (% of children under 5)		33.6	24.2	23.4
Primary school completion rate	52	34	61	67
HIV prevalence (age 15-49)	1.7	2.2	1.2	0.7
GDP (\$US billions)	9.35	19.09	20.52	31.93

## Appendix 4

### Select survey questions and responses

Question	Explanatory note	Range or TOTAL across all observations	Hospitals  Range, (median)	Health Center  Range, (median)	Community care site  Range, (median)
1) What is the total cost of simple pneumonia treatment?	Responses included the cost of consultation, lab tests, x-ray, and drugs (if available)	\$0–\$20 USD	\$5–\$20 (\$10)  (n=7)	\$2–\$7 (\$6)  (n=3)	\$0 (\$0)  (n=1)
2) What is the total cost of severe pneumonia treatment?	Responses included the cost of consultation, hospitalization lab tests, x-ray, and drugs including oxygen (if available)	\$20–\$50	\$20–\$50 (\$40)  (n=5)	N/A	N/A
3) If ever, when is the last time you have received training on diagnosing and treating pneumonia?	Within last six months	3	2		1
	Within last two years	1		1	
	Within last five years	3	1	1	1
	Never	4	4		
4) What are some of the clinical signs used in the assessment of children with	Fast respiratory rate	10	5	3	2
	Lower chest wall indrawing	1			1
	Stridor	1	1		

possible pneumonia?	Intercostal indrawing	1	1		1
	Fever	4	2	2	
	Cough	10	6	3	1
	Wheezing	2	1		1

Appendix 4: A total of 15 providers were visited. Not all providers answered all questions. Q1: Open-ended numeric question. Q2: Open-ended numeric question. N/A is shown as health centers and community care sites do not treat severe pneumonia. Q3: One health center did not answer this question. One community care site that did not answer pricing questions did answer this question on training. Q4: Select multiple responses.

## Appendix 5

### Example of PNIRA community outreach documentation



République Démocratique du Congo  
**MINISTÈRE DE LA SANTÉ PUBLIQUE**  
**PROGRAMME NATIONAL DE LUTTE CONTRE**  
**LES INFECTIONS RESPIRATOIRES AIGUES**  
**PNIRA**



**MESSAGES CLES POUR LA PREVENTION DE LA PNEUMONIE**

1.		<p>Chers parents et membres de la communauté faites vacciner complètement votre enfant avant son premier anniversaire afin de le protéger contre la survenue de la pneumonie.</p>
2.		<p>Chères mères donnez exclusivement le lait maternel à votre enfant afin de lui donner les anticorps qui le protégeront contre la survenue de la pneumonie.</p>
3.		<p>Chers parents et membres de la communauté évitez d'exposer les enfants à toutes sortes de fumées surtout à l'intérieur des maisons d'habitation pour le protéger contre la survenue de la pneumonie.</p>
4.		<p>Chers parents et membres de la communauté évitez d'exposer les enfants au froid (courant d'air, ventilateur, climatisation, boisson ou aliment froids, ...) pour les protéger contre la pneumonie.</p>
5.		<p>Chers parents et membres de la communauté évitez d'exposer les enfants à toutes sortes de poussières pour les protéger contre la survenue de la</p>

#### Key messages for the prevention of pneumonia\*

Dear parents and members of the community, have your child fully vaccinated before the first birthday to protect against the onset of pneumonia

Dear mothers, give your child exclusively breast milk to give him the antibodies that will protect him against the occurrence of pneumonia.

Dear parents and community members avoid exposing children to all sorts of smoke especially inside the houses to protect them against the occurrence of pneumonia

Dear parents and community members avoid exposing children to cold (draft, ventilator, air conditioner, cold food etc.) to protect them against pneumonia

Dear parents and community members, avoid exposing children to all kinds of dust to protect them from the onset of pneumonia

Note: PATH translation to represent the type of content, translation errors are possible



## Appendix 6

### Background on the Lives Saved Tool (LiST)

LiST was developed by a consortium of academic and international organizations led by the Institute for International Programs at the Johns Hopkins Bloomberg School of Public Health in Baltimore, Maryland. Development of the tool has been funded by the Bill & Melinda Gates Foundation. The tool includes data from variety of sources, including peer-reviewed journals, the United Nations Population Division, the Demographic and Health Surveys (DHS) Program, and the Multiple Indicator Cluster Surveys (MICS). LiST aims to “improve the quality of information available to support public health policies and decision making” (see <http://livessavedtool.org/how-list-works>). The focus of the model is quantifying the potential number of lives saved with changes in intervention coverage rates in low- and middle-income countries.

PATH used the current version of the Lives Saved Tool (LiST; version 5.61) to estimate the reduction in mortality that would result from scaling up oral antibiotics for treatment of pneumonia in the DRC. The baseline data, including data from the 2013–2014 DRC Demographic and Health Survey final report and other sources, were not adjusted. The type of oral antibiotic modeled is not specified. LiST assumes a 70 percent oral antibiotic effectiveness rate for pneumonia in children under the age of five. The LiST model ensures that there is no double counting of the lives saved impact when multiple interventions are scaled up simultaneously. The model assumes that each death is due to a single cause and that each death can only be prevented once.

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