

Original citation:

Ward, Peter M. (2014) Patient-centric healthcare supply chains in sub-Saharan Africa : state of the art and possible implications. Working Paper. Coventry: Warwick Manufacturing Group. WMG Service Systems Research Group Working Paper Series (Number 03/14).

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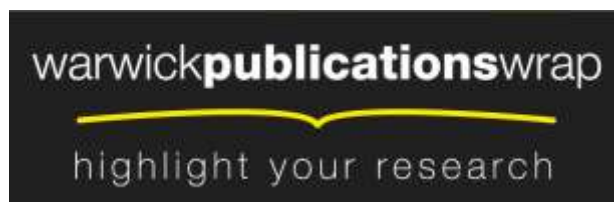
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Patient-Centric Healthcare Supply Chains in sub-Saharan Africa: State of the Art and Possible Implications

Peter Ward

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WMG Service Systems Research Group Working Paper Series

Issue number: 03/14

ISSN: 2049-4297

May 2014

Patient-Centric Healthcare Supply Chains in sub-Saharan Africa: State of the Art and Possible Implications

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Acknowledgements:

This paper is one output of an agreement between the Bill and Melinda Gates Foundation and the University of Warwick to review extant academic literature, grey literature and publicly available company information. The author gratefully acknowledges the financial support provided by the Foundation for this work.

If you wish to cite this paper, please use the following reference:

Ward P (2014) *Patient-Centric Healthcare Supply Chains in sub-Saharan Africa: State of the Art and Possible Implications*. WMG Service Systems Research Group Working Paper Series, paper number 03/14, ISSN 2049-4297.

Patient-Centric Healthcare Supply Chains in sub-Saharan Africa: State of the Art and Possible Implications

Overview

This paper addresses the following questions:

1. What is the current State of the Art in terms of research into patient-centric healthcare supply chains?
2. Based on the State of the Art and thought leadership in this area, what are some possible implications for the future in terms of drug product design, drug supply chain, ICT enablement and business models in the context of sub-Saharan Africa?

The results of the reviews are presented in this paper under the following headings:

- Executive summary
- Introduction
- Literature review and analysis questions
- Patient-centric healthcare supply chains
- Implications for the future in sub-Saharan Africa
- Overall conclusions and recommendations
- Bibliography

Executive Summary

This review uses the results of a literature review into patient-centric healthcare supply chains as the basis for identifying implications for sub-Saharan Africa. Implications are identified in the areas of business models, ICT, drug design and drug supply chains.

The primary conclusion is that internal and external pressures on healthcare supply chains in sub-Saharan Africa mean that change is required. The main recommendation is that research should be performed to improve the understanding of issues around patient adherence in resource-poor environments in sub-Saharan Africa as the basis for planning change.

Introduction

The twin purposes of this literature review assessment and analysis are to understand the current state of research into patient-centric healthcare supply chains, and to identify possible future implications on drug product design, drug supply chains, ICT enablement and business models in the context of sub-Saharan Africa. The review addresses the two purposes sequentially.

First, the State of the Art of research into patient-centric healthcare supply chains is addressed. The literature review commences with a review of current topics in supply chain theory and practice and consumer centricity before focusing on healthcare supply chains. It then looks at research into patient centricity, and finally combines these to understand the current state of research into patient-centric healthcare supply chains.

Second, the implications are considered. The context of sub-Saharan Africa is established first. Following this, the implications on the four specified areas are analysed.

Finally, the broader implications of the two questions are considered together.

The approach taken for the literature review has been advocated by Hagen-Zanker & Mallett (2013) of the Overseas Development Institute (ODI) think tank. They propose a reflexive method that includes 3 “tracks” of information retrieval: academic literature, “snowballing”, and “grey literature”. “Snowballing” refers to the process of actively seeking out additional material through use of references in key publications and by consulting experts for their guidance on important papers. These introduce an element of subjectivity in the selection of material but give a sense of which literature has been influential in the field. “Grey literature” means non-peer reviewed material, which in this study included articles and reports from Non-Governmental Organisations (NGOs) and donors, reports and policy documents from the United Nations and other official Governmental publications, articles and editorials published in trade magazines and journals, and corporate documents. Inclusion of grey literature must be done with care because of the potential for variable quality, but it can increase the breadth, relevance and value

of the final review and is particularly recommended for research in International Development. In the case of healthcare supply chains in sub-Saharan Africa, the inclusion of non-academic material is especially valuable because of the paucity of peer-reviewed academic research.

Literature Review and Analysis Questions

The two questions composing the assessment and analysis are:

1. What is the current State of the Art in terms of research into patient-centric healthcare supply chains?
2. Based on the State of the Art and thought leadership in this area, what are some possible implications for the future in terms of drug supply chain, drug product design, ICT enablement and business models in the context of sub-Saharan Africa?

The questions will be considered separately and then the results combined.

1. Patient-centric healthcare supply chains

This section addresses the first question, namely:

What is the current State of the Art in terms of research into patient-centric healthcare supply chains?

The section looks in turn at supply chains and customer centricity in general, before moving on to consider healthcare supply chains, patient centricity and finally patient-centric healthcare supply chains. A conclusion identifies the key areas that then feed into the analysis for the second question.

Current topics in supply chain theory and practice

“The supply chain — a term now commonly used internationally — encompasses every effort involved in producing and delivering a final product or service, from the supplier's supplier to the customer's customer.”

This definition of the term “supply chain”, quoted by Lummus & Vokurka (1999), originated from the Supply Chain Council (SCC 2012). The SCC is a global non-profit organisation that exists to help its members improve the performance of their supply chains. It was established in 1996 to define and promote best practice in supply chain management (SCM). Its Supply Chain Operations Reference (SCOR) process reference model is considered within manufacturing industry to embody supply chain management’s state of the art. The SCC now has almost 1000 companies as corporate members.

The term “supply chain management” (SCM) is used in academia and business to refer to the management processes governing supply chains. It was introduced by Oliver & Webber in 1982. A second industry body, a professional institute called The Council of Supply Chain Management Professionals, was founded in 1963 and represents SCM practitioners in 67 countries. It defines SCM as follows:

“Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies” (CSCMP 2013, quoted in Gibson et al. 2005).”

To achieve a broad perspective quickly, a review of literature reviews was performed. This allowed this review to build on the consolidations and conclusions of other experts, and then to provide its own holistic analysis to reach a perspective on current topics.

In line with the stated method, a search of EBSCO and JSTOR databases for the terms “supply chain” and “literature review” in the title published since 2000 listed 20 papers which were then supplemented with 21 further recommended and relevant papers to give a list of 41 documents. The approach was not necessarily comprehensive in terms of incorporating every document but aimed to be so for the major themes.

The 22 journals contributing to the study are listed in Table 1.

Table 1: Journals contributing to the review

Journal abbreviation	Count	Journal full name
BH	1	Business History
CII	1	Computers In Industry
CSREM	1	Corporate Social Responsibility and Environmental Management
EJM	1	European Journal of Marketing
EJPSM	2	European Journal of Purchasing & Supply Management
ESA	1	Expert Systems with Applications
GJFSM	1	Global Journal of Flexible Systems Management
IJLM	3	The International Journal of Logistics Management
IJOPM	4	International Journal of Operations & Production Management
IJPDLM	1	International Journal of Physical Distribution & Logistics Management
IJPE	2	International Journal of Production Economics
IJPPM	2	International Journal of Productivity & Performance Management
IJPR	3	International Journal of Production Research
IMDS	3	Industrial Management & Data Systems
JAMS	1	Journal of the Academy of Marketing Science
JBL	2	Journal of Business Logistics
JMPP	1	Journal of Management Policy and Practice

Journal abbreviation	Count	Journal full name
JMTP	1	Journal of Marketing Theory and Practice
JSCM	1	Journal of Supply Chain Management
PPC	1	Production Planning & Control
SCMIJ	7	Supply Chain Management: An International Journal
TR pt E	1	Transportation Research Part E

The 41 documents used in the supply chain literature review are listed in Table 2, along with the main conclusions drawn from each document. Grey literature was then introduced in subsequent healthcare-related sections where less research has been performed, complementing the academic papers.

Table 2: Literature included in the Review

Journal	Reference	Topic	Themes and conclusions
JMTP	Larson & Rogers 1998	SCM definition	Development of the term SCM
IJOPM	New 1996	Supply chain improvement	Supply chain focuses on “effective purchasing and distribution”, “long-term relationships between trading partners”, and “operational integration of trading partners”
IJLM	Bechtel & Jayaram 1997	SCM	Strategic aspects of SCM
IJLM	Cooper et al. 1997	SCM and logistics	SCM: coordination between supply chain partners is more than just logistics
IJLM	Lambert et al. 1998	Implementing SCM	Successful implementation of SCM
IMDS	Lummus & Vokurka 1999	SCM	Development of the term SCM. Guidance on SCM
EJPSM	Croom et al. 2000	SCM analytical framework	Literature categorisation. Noted a lack of theoretical SCM work
EJPSM	Tan 2001	SCM analytical framework	SCM’s aim is “waste elimination and increased efficiency”
IMDS	Lummus et al. 2001	SCM and logistics	SCM and logistics are often confused. A commonly agreed understanding is necessary
JBL	Mentzer et al. 2001	SCM	SCM is “to deliver lower costs, increased customer value and satisfaction, and competitive advantage”
IJPDLM	Svensson 2002	SCM and marketing	“The theoretical foundations of SCM are derived from... the functionalist theory of marketing”
TR pt E	Meixell & Gargeya 2005	Supply chain design	Supply chain models must take account of manufacturing locations and support multiple tiers. Performance measures must address alternative objectives. More industries must be investigated in the context of global supply chain
JBL	Gibson et al. 2005	SCM	How the CSCMP definition of SCM was achieved

Journal	Reference	Topic	Themes and conclusions
IJOPM	Burgess et al. 2006	SCM	SCM is a “young” research field. “Exponential growth” in research. “The robustness of the ideas underpinning SCM have not been fully tested”. A “need to move beyond positivist methods of research”
IJPE	Vonderembse et al. 2006	Supply chain theory development	Standard products should use lean supply chain; innovative products (“adaptable to changing customer requirements”) should use agile supply chain. Hybrid supply chain with delayed customisation (postponement) can add innovative elements to standard products
IJOPM	Storey et al. 2006	SCM theory development	“Substantial gaps between theory and practice”. Who should manage the supply chain?
SCMIJ	Halldorsson et al. 2007	SCM theory development	There is no unified theory of SCM but different ones can be chosen depending on the situation
IJPR	Gunasekaran & Kobu 2007	Supply chain performance measurement	“Customer satisfaction has not been given due consideration in measuring the performance of supply chain”
JSCM	Borade & Bansod 2008	SCM	“Researchers should make an industry-centric research to explore the full potential of SCM”
GJFSM	Siddiqui et al. 2009	SCM in context of Total Quality Management	Flexibility is important: “reasonably priced customised products of high quality that can be quickly delivered to customers”
EJM	Athanasopoulou 2009	Relationship quality	RQ: “trust, commitment, satisfaction”. “The role of the environment is neglected”. There is “no accepted framework” for research
IMDS	Hilletofth 2009	Supply chain strategy	Two case studies show the possibility of combining different supply, manufacturing and distribution strategies
BH	Alfalla-Luque & Medina-López 2009	SCM development	Research is developing rapidly but more research is required
JAMS	Stock & Boyer 2009	SCM definition	“There is too much disagreement as to what SCM is and what functions and/or processes it includes”
CSREM	Gold et al. 2010	Sustainable supply chain	“Collaborative paradigm” emerged as a result of environmental concerns driving supply chains to act as “meta-organisations”
IJPR	Arzu Akyuz & Erman Erkan 2010	Supply chain performance measurement	Balanced Scorecard and SCOR model are important. Frameworks and models are immature. More research on metrics/KPIs
JMPP	Naslund & Williamson 2010	SCM definition	SCM is complex and still poorly defined
SCMIJ	Delbufalo 2012	Inter-organisational trust	“Supply chains need to align their constituent companies to become more customer-oriented and deliver increased levels of customer value”
SCMIJ	Gligor & Holcomb 2012	Supply chain agility	Increasing demand for agility. Logistics can contribute
IJPE	Hassini et al. 2012	Sustainable	Needs industry-specific research. No research

Journal	Reference	Topic	Themes and conclusions
		supply chain	found linking inventory management with sustainability
CII	Zeng et al. 2012	Secure collaboration	Secure collaboration is vital. The issue is the need to simultaneously share and protect information in cooperation/competition situations
ESA	Marra et al. 2012	Knowledge management	"Knowledge management is a tool for supply chain integration". Knowledge flow between partners is important but needs more research
IJPPM	Gopal & Thakkar 2012	Supply chain performance measurement	Improvement in metrics over the last decade, eg. six-sigma, SCOR, KPIs. Need evidence of impact on performance of concepts like knowledge management
SCMIJ	Miemczyk et al. 2012	Sustainable supply chain	More focus on environmental sustainability than social sustainability, eg. social equity, ethics, health & safety, community. How can eg. NGOs contribute?
IJPR	Simangunsong et al. 2012	Supply chain uncertainty	14 sources of uncertainty identified, and 2 approaches: reducing and coping. ICT important for reducing. Coping strategies include postponement, flexibility, buffer stock, analytics
SCMIJ	Ashby et al. 2012	Sustainable supply chain	Literature tends to focus on processes and "hard quantifiable elements"
SCMIJ	Fayezi et al. 2012	Agency theory	Can be applied to information sharing, shared risk/reward, supply chain communication, and relationship maintenance
SCMIJ	Wong et al. 2012	Supply chain alignment	"Supply chain has to be aligned to deliver customer value, measured in terms of customer-perceived benefits gained". 6 enablers of alignment identified including customer relational behaviour
PPC	Alfalla-Luque et al. 2013	Supply chain integration	Dimensions of integration: "information integration, coordination and resource sharing, and organisational relationship linkage"
IJOPM	Shi & Yu 2013	Financial performance	ICT and external relationships are factors shown to improve supply chain performance
IJPPM	Taticchi et al. 2013	Sustainable supply chain	Increasing focus on performance measurement of sustainable supply chain. Little focus on measuring social performance. North America and Europe are the focuses of research

Conclusions arising from this analysis include:

- There has been a dramatic increase in supply chain literature reviews during the period. This probably reflects increasing interest in, importance of, and maturity of, the field
- Nevertheless SCM is still considered to be an immature research field. There is no single theory of SCM, nor are the various underpinning theories mature or fully tested. There is a need to do more qualitative research as well as just quantitative research

- There are gaps between supply chain theory and practice. For example, the theory of end-to-end management of a supply chain is not easily translated into practice
- Sustainability and environmental concerns were covered by 5 literature reviews. These topics are considered to be driving closer supply chain partnerships. However, there is a recommendation that social sustainability should be a stronger focus of research, not just environmental sustainability
- Inter-organisational integration and alignment are the subject of 4 literature reviews. Supply chain partners face the challenge of sharing information in a way which exposes enough to make collaboration possible but without sharing too much with partner companies that are also potential or actual competitors
- Performance is also the subject of 4 literature reviews. One recommendation is that performance measurement should take greater account of customers and customer satisfaction
- It is recognised that supply chains must become more customer-oriented and deliver better value propositions to customers
- Implementation of Information & Communications Technology (ICT) has been shown to help to improve supply chain performance. One contribution it can make is by improving information integration
- Relationship quality with customers is considered to be an important but weakly defined field. The environment in which the relationship exists has been neglected. This may be an important aspect of multi-country research where cultural factors influence the strength of relationships
- Research is increasingly focusing on agile supply chains rather than lean ones. This may be because agile thinking is perceived to be a prerequisite for survival in uncertain marketplaces. Hybrid supply chains are sometimes proposed as a way of achieving the best of both
- The concept of postponement repeatedly arises both implicitly and explicitly, not least as a way of contributing to hybrid supply chain thinking. Postponement refers to delayed product customisation taking place close to the customer (Boone et al. 2007)
- There are recommendations to investigate industry-specific supply chains and to perform more research in geographies outside North America and Europe.

In summary, current supply chain topics documented from this review of literature reviews are:

1. Supply chain performance, including the application of financial measurements
2. Supply chain sustainability, both environment and social
3. Supply chain agility, including the contribution of postponement
4. Supply Chain Management, including the contributions of ICT and knowledge management
5. Closer integration of supply chain partners and the issue of who manages the supply chain end-to-end
6. The need to perform research in the developing world

7. The need to get closer to the customer.

This review will now focus on customer/consumer centricity as a lead-in to patient centricity.

Consumer centricity

The Collins English Dictionary (2013) defines “customer” as “a person who buys” and “consumer” as “a person or thing that consumes”. Therefore it is customers who pay; they may also be consumers but are not always so. Examples of where the customer is not the consumer include in-company employee helpdesks and free (or free-at-the-point-of-delivery) healthcare services.

However, in supply chain literature the roles of consumer and customer are generally conflated unless it is necessary to distinguish between them. For example Jüttner, Christopher, & Baker (2007) refer to the need for product variety to “match what consumers want to buy”. However, supply chain literature will distinguish the roles when it is necessary to emphasise the final customer in the chain and not one of the supply chain partners. In these cases, the term “end-consumer” is sometimes used to make this totally clear. An example is Thubliet, Hanby, & Shi (2010), which also refers to “consumer/customer” to highlight the fact that they are referring to a person who is both the “end-consumer” and the one paying.

Hence both customer centricity and consumer centricity are discussed in supply chain literature. The meaning is generally the same except at times when authors find it necessary to distinguish between them.

Historically, delivering what the customer was perceived to want was the limit of customer-centricity. As Collin, Eloranta, & Holmström (2009) said, this amounted to “cost reduction and fast delivery”, an approach which they identified as originating in operations management. Supply chain design has become more sophisticated, with for example segmentation into lean, agile and hybrid designs depending on product type (Rahimnia & Moghadasian 2010). However, supply chain measurement has tended to remain focused on tangible factors such as reliability and responsiveness, even though it has been pointed out by Jüttner et al. (2007) that improved supply chain efficiency by itself does not increase customer satisfaction. Their recommendation was that the supply chain had to “begin with the customer”. In order to achieve this it is necessary for supply chain partners to know what customers value.

There is a growing body of literature that relates back to before Adam Smith in “Wealth of Nations” (1776, referred to in Vargo & Lusch, 2004) wrote that the exchange of goods was the measure of a country’s economy. It seems that he chose this because it was in line with the socio-political views of the time, and it was a departure from the then-accepted view of economists that value is produced only when the consumer makes use of an offering. Those who pursue research into pre-“Wealth of Nations” views refer to this approach as Service-Dominant Logic (SDL) and call Smith’s new measure Goods-Dominant Logic (GDL) in contradistinction

(Vargo & Lusch 2004; Vargo & Lusch 2008). In SDL, the supply chain provides a value proposition but the consumer determines the value of the offering in their context (Chandler & Vargo 2011; Ng 2013). In SDL, value is seen as being co-created by the customer from the value proposition in context, and so the term “consumer” is deprecated as it implies a passive utilisation rather than an active participation.

A framework for the concept of value within SDL has recently been provided by Ng & Phillips (2013). In their work they refer to “phenomenal-consciousness value” (P-C value) as being equivalent to the co-creation of value in context. They mention 5 facets: the offering, the offering’s affordance (what it provides), the context, the agency (the ability for the customer to take action – or from an opposite perspective, the lack of constraints on them), and the customer’s resources (skills and competencies) (ibid., p.228-229). From these it can be seen that value will depend on the context, the customer’s skills and the customer’s ability to take action just as much as on the value proposition embodied in the offering. Therefore it is recognised that to be customer-centric requires an understanding by supply chain partners of customers’ contexts, skills and constraints – an understanding of customers’ practices (Grönroos 2008) – while creating their value proposition. Further, since the customer’s contexts, skills and constraints are variables outside the control of the supply chain partners, then by augmenting the offering’s value proposition it may be possible to reduce their variability and so enable customers to achieve higher value in use. This is perhaps the most useful aspect of customer-centricity to focus on because it should lead to increased customer satisfaction.

Healthcare supply chains

Healthcare supply chains are important contributors to healthcare systems, which the World Health Organisation defined as “the organizations, institutions and resources that are devoted to producing health actions. A health action is defined as any effort, whether in personal health care, public health services or through intersectoral initiatives, whose primary purpose is to improve health” (Musgrove et al., 2000, p.xi). Theoretically, healthcare supply chains are no different to those in any other industry, though it is acknowledged that in practice they “may be 30 years behind the grocery business in terms of sophistication” (Ebel, Larson, & Shah, 2012, p.12). Just as in other industries, their function “encompasses every effort involved in producing and delivering a final product or service, from the supplier's supplier to the customer's customer” (SCC 2012).

One difference that the literature mentions (Pedrosoa & Nakano 2009) is patients not having “purchasing decision power”. However, as indicated earlier there are supply chains in other industries where this is the case. This is therefore not unique to healthcare, though it may be unusual.

There may be two differences, however, which do make healthcare supply chains different. The first is the range of external organisations which can affect the supply chain. Regulators, payers, patients, physicians and pharmacists are all stakeholders who must be considered in supply chain design (Laws 2013a), to which should be added Ministries of Health (MoHs) -- there is significant involvement of the public

sector in healthcare supply chains. Regulators and MoHs determine the conditions under which a drug can enter a market. Payers (insurance companies and MoHs in mature markets, MoHs and donors in emerging markets) decide on priorities and prices. Physicians and pharmacists judge which drug should be used among the range of options. This range of participation alongside the core relationship between the supply chain partners and the patient can add complexity, which may then impact the clarity of purpose for supply chain partners.

The second is the ultimate objective of healthcare supply chains. While supply chain partners in the grocery business may be interested in customer satisfaction, healthcare supply chain partners know that the outcome of their work can make the difference between life and death. Despite this, a recent literature review on the pharmaceutical supply chain (Narayana et al. 2014) determined the four dimensions of “final value delivered to the consumer” as being “availability, access, affordability and safety”; this suggests that the literature lags practice. One of PwC’s series of pharmaceutical reports (Friend et al. 2011) found that one of seven “forces” on the industry is “the increasing emphasis on outcomes”. It points out that payers want to see both evidence of medicine effectiveness as well as patients receiving supporting services to maximise effectiveness. As a result, a trend towards “pay for performance” is already emerging and is expected to increase (Friend, Arlington, Evans, et al. 2009).

The suggestion that healthcare supply chains are “30 years behind” (Ebel et al. 2012) the current state of the art brings additional complication to research. This is because it cannot be assumed that any research environment will reflect current supply chain thinking. It is likely that a healthcare supply chain practitioner, especially in the developing world, will have a different level of maturity to that expected of a supply chain manager in a retail business.

Patient centricity

As Musgrove et al. (2000) say of clinical services, “At the centre of service delivery is the patient”. The pharmaceutical industry is aiming to support this through the provision of patient services, thus improving its value proposition to patients. Such services are generically referred to as “beyond the pill” (Laws 2013a; Wenzel et al. 2013; EyeForPharma 2013; Laws 2013b) in reference to them extending the service which the healthcare supply chain partners currently provide through the provision of drugs.

These are delivered in two ways. The first is services which are separate from drugs, such as Pfizer Integrated Health’s healthcare offerings (Pfizer Integrated Health 2013) which are aimed at improving employee wellness through health schemes provided by companies and unions, and AstraZeneca’s mHealth initiative (Handford 2013) which will provide personalised support to patients and allow them to record their clinical data.

The second is services which are linked to or associated with drugs. Of these, perhaps patient adherence (or compliance) is the most favoured at present. As

Firlik (2013a) says, “Pharmaceutical companies are interested not only in selling pills, but in selling pills that actually work... Doctors intuitively understand the critical role that adherence plays in clinical outcomes”. The World Health Organisation has endorsed the idea that increasing adherence “may have a far greater impact on the health of the population than any improvement in specific medical treatments” (Sabate 2003 p.xiii).

What is stopping patients from achieving higher adherence rates than the 50% or so commonly reported? (Sabate 2003; Marcus 2013; Brown & Bussell 2011). Sabate's report for the World Health Organisation (WHO), “Adherence to Long-Term Therapies”, identified five interacting dimensions of adherence: socioeconomic factors, factors associated with the health care team and system in place, disease-related factors, therapy-related factors, and patient-related factors. Salmane-Kulikowska & Dobelniece (2012) drew together a wide-ranging list of factors affecting adherence, including demographic, socio-economic, socio-psychological, health status, disease severity, health beliefs, parental example, usage information, depression, personal traits, economic and cultural factors.

However, this research is primarily Western in focus and potentially misses factors or details which may be localised to other parts of the world. It is recognised that patients “in emerging countries, for example, may have substantially different wants and preferences in terms of pharmaceutical product taste, texture, package size, unit dosing, or services” (Reynolds 2013). While there has been significant research into adherence in HIV/AIDS patients in Africa (for example Adewuya et al. 2010; Skovdal et al. 2011; Murray et al. 2009; Dahab et al. 2008; Roura et al. 2009; Weiser et al. 2010; Bisson et al. 2008), the HIV/AIDS focus has been perhaps 90% of all such research and therefore it is likely that further important information on reasons for non-adherence has not yet been captured.

Through all this it must be remembered that patients create value by their practices, and therefore a deep understanding of people's practices must be the basis for developing truly patient-centric offerings that will provide patient-perceived value and satisfaction (Grönroos 2008). This implies a need for more research into how drug-related “beyond the pill” offerings can truly improve the value propositions of their associated drugs. In the final analysis, this is important as making sure drugs are effective (Brake 2013).

Patient-centric healthcare supply chains

Supply chains can be viewed as value co-creation networks that deliver value propositions (Tokman & Beitelspacher 2011). There is now increasing recognition that the primary purpose of a supply chain is to deliver customer-perceived value and satisfaction (Wong et al. 2012; Stock et al. 2009). Many recent papers (for example Hilletofth 2011; Jüttner et al. 2007; Jüttner et al. 2010; Bustinza et al. 2013; Stank et al. 2012) highlight the need to understand customer needs and then make them known to supply chain partners.

Firlik said (2013a), “What we need are new ways to improve human motivation to take the medications that can prevent [disease] in the first place... The holy grail here is to add motivation innovation to the mix, to reach the under-motivated folks who represent the most serious risk to poor outcomes”. While this may be valid, this omits the possibility that some people, however motivated, are unable to take their drugs due to – from an SDL perspective – their context, the constraints on them, a lack of resources, or a combination of all three. This should drive a desire for supply chain partners to become much more aware of the patient’s real needs in order to increase adherence. As Friend et al. said (2011) “[pharmaceutical manufacturers must] acquire a much deeper understanding of patients in a world where outcomes count for everything”. In part at least, this is because of “shifting demand in healthcare towards products accompanied by services, that pushes for outcomes-based reimbursement” (Sharp 2013).

In order therefore to move towards genuine patient-centric healthcare supply chains, it will be necessary first to gain a deeper understanding of patient needs, second to communicate these to supply chain partners, and third to determine how and where in the supply chain to make changes to improve value propositions. With this approach there is the opportunity to deliver “beyond the pill” solutions that improve patient adherence and thus enhance outcomes. Contributors to such solutions may include changes to the supply chain and to product design, and may require enhanced ICT support. An outcome may be changes to business models. These will be considered in the second part.

Conclusions

This literature review has used the Overseas Development Institute-suggested process to gather material from academic and grey literature sources to provide a balanced view of the State of the Art in patient-centric healthcare supply chains. From this, the following conclusions can be drawn:

1. Supply chain performance, sustainability and agility are very current topics in supply chain research generally. Sustainability includes both environmental and social aspects. Agility includes the concept of postponement, ie. delaying final product configuration until an appropriate point in the supply chain between manufacture and consumption
2. Current areas of Supply Chain Management focus include ICT and knowledge management. The context for both includes the need for closer integration of supply chain partners, and one driver for this is to share customer-originated information as supply chains are driven to get closer to the customer
3. Getting closer to the customer is another way of referring to increasing customer centricity. Customer centricity includes learning about the customer’s environment in order to deliver enhanced value propositions
4. Healthcare supply chains have two features which make them diverse from those in other industries: the range of external organisations that can affect them and the ultimate objective of making life-and-death interventions. The pressures from these features are driving an increased focus on patient centricity and outcome-dependent payment

5. Patient centricity puts patients at the heart of the healthcare supply chain. One way of achieving this is through improving patient adherence as part of “beyond the pill” initiatives. While this has been researched in detail for some disease types, much more must be done especially in the developing world before healthcare supply chains can be truly said to be patient-centric
6. The World Health Organisation has said, “Access to medication is necessary but insufficient in itself for the successful treatment of disease” (Sabate 2003 p.xiii). A major opportunity exists for research into adherence issues in sub-Saharan Africa using Service-Dominant Logic concepts. The aim would be for supply chain partners to acquire a much deeper understanding of patients’ needs in context and so improve the ability for patients to achieve adherence without further interventions.

2. Implications for the future in sub-Saharan Africa

This section addresses the second research question, namely:

Based on the State of the Art and thought leadership in this area, what are some possible implications for the future in terms of drug product design, drug supply chain, ICT enablement and business models in the context of sub-Saharan Africa?

The section builds on the assessment created in the first section for supply chains and consumer centricity to identify and analyse the implications for each of the four listed areas. It first defines the sub-Saharan African context and ends with conclusions.

The sub-Saharan Africa context

The United Nations (United Nations Statistics Division 2013) defines sub-Saharan Africa in this way:

“The designation sub-Saharan Africa is commonly used to indicate all of Africa except northern Africa, with the Sudan included in sub-Saharan Africa”.

By this definition, the countries listed in Table 3 are included as per the same United Nations source.

Table 3 : List of Countries in sub-Saharan Africa (United Nations Statistics Division 2013)

<i>Northern Africa</i>	<i>Eastern Africa</i>	<i>Middle Africa</i>	<i>Southern Africa</i>	<i>Western Africa</i>
Sudan	Burundi	Angola	Botswana	Benin
	Comoros	Cameroon	Lesotho	Burkina Faso
	Djibouti	Central African Republic	Namibia	Cape Verde
	Eritrea	Chad	South Africa	Cote d'Ivoire
	Ethiopia	Congo	Swaziland	Gambia
	Kenya	Democratic Republic of the Congo		Ghana
	Madagascar	Equatorial Guinea		Guinea
	Malawi	Gabon		Guinea-Bissau
	Mauritius	Sao Tome and Principe		Liberia
	Mayotte			Mali
	Mozambique			Mauritania
	Réunion			Niger
	Rwanda			Nigeria
	Seychelles			Saint Helena
	Somalia			Senegal
	South Sudan			Sierra Leone
	Uganda			Togo
	United Republic of Tanzania			
	Zambia			
	Zimbabwe			

Sub-Saharan Africa is a valid exemplar of the developing world. 34 out of 49 countries defined by the United Nations as being “Least Developed Countries” (LDCs) are in the region (UN-OHRLS 2013). These countries are marked by low income, low literacy rates, high population growth, high child mortality rates, and reduced life expectancy. The SSA population is almost 1 billion people. It provides a set of value-in-context challenges which are likely to include both practical and sociological elements.

While it is not possible to get detailed figures for the value of drugs which pass through the healthcare supply chains in SSA, several billion dollars per year are donated to major healthcare programs such as for malaria and HIV/AIDS. Taking an alternative approach to quantifying it, it is estimated that around 5% of Gross Domestic Product (GDP) is spent on healthcare in SSA (Kaseje 2006); in 2012 GDP in SSA was assessed as being \$1.3 trillion (IMF 2013) suggesting that healthcare is conservatively a \$30 billion business in SSA. Healthcare supply chains in SSA therefore provide both a rich vein of information to mine at the patient level in order to improve supply chain value propositions, and the potential to make a significant impact on people's lives.

Implications for drug product design

This is primarily a patient centricity issue. When considering drug product design, it is important to understand drug use in the developing world. PwC's 2011 report, *Supplying the Future* (Friend et al. 2011), provided some insights into this. It said, "The choices they make are often based on different values from those that influence the design of products and services intended for consumption in the developed world. Cost and the ability to buy on a daily or weekly basis are more important than convenience, for example". This example of packaging and pricing drugs based on daily personal cashflow rather than on a periodic (eg. monthly) discounted lump sum basis fits with the regularly heard expression, "30 [currency units] a month is too much, but 1 a day is affordable".

The report goes on to say that it is important that pharmaceutical companies should "understand the needs of patients living in these countries and tailor its offerings accordingly". This could be package size as indicated above. It could also involve offerings that are easier to consume in SSA conditions, such as through sublingual (SL) administration rather than as tablets that must be taken with water.

While the need is clearly summed up by the PwC report, and obvious examples can be multiplied, what is urgently required now is field research into patient needs in the developing world. It is important to determine what is valued by patients in resource-poor environments. In Service-Dominant Logic terms, this means understanding what alternative value propositions would provide greater value-in-context for patients at the point of consumption (value co-creation). Changes in this area could make significant improvements to patient adherence, so improving patient outcomes.

Implications for drug supply chains

Both patient centricity and supply chains contribute to this topic. The implications for drug design above may also be delivered selectively/wholly and temporarily/permanently by changes to the supply chain. Postponement (Boone et al. 2007) could be one basis for such changes. Taking the earlier example, if a drug is delivered in a form that requires it to be taken with water then a product design change to improve patient adherence could be to deliver it in SL form. An equivalent supply chain design change could be to provide a bottle of water as part of the drug prescription. Depending on the preferences of pharmaceutical companies, donors, regulators and MoHs, this could be a permanent or temporary (pending drug redesign) change. It could also be selective, only being provided at certain times of year or to particular sub-sections of the population.

Ideally the needs of patients would also be taken into account. As with the implications on drug product design, this would require research into patient preferences in the developing world to understand their preferred value proposition(s). Service-Dominant Logic thinking would be a valid approach for this. Research into the relative improvement in patient adherence of each option may also provide useful information when choosing the approach.

Such interventions would potentially require closer integration of supply chain partners in order for them to determine the optimum point of postponement and the details of the arrangements. For example, if a bottle of water is to be “inserted” into the supply chain for each pack of a certain drug, is that done at the central warehouse, the regional warehouse, the district store or the health facility? Who is responsible for purchasing the water? Is it ordered through the normal healthcare supply chain processes? These and other questions, discussed by supply chain partners, will determine the most beneficial and cost-effective approach for such interventions.

More widely, it is evident from the review of supply chain literature that in general there is a need for more healthcare supply chain-specific research and more geography-specific research. The majority of supply chain research has been conducted in North America and Europe on industrial supply chains; healthcare supply chains in sub-Saharan Africa are under-researched.

Implications for ICT enablement

Information and Communications Technology has transformed many businesses and has contributed to improvements in supply chain processes in many industries, most notably through improved communication between supply chain partners (Shi & Yu 2013; Simangunsong et al. 2012; Gligor & Holcomb 2012). There has been limited application of ICT to healthcare supply chains in the developing world, at least downstream from central warehouses where paper-based processes still predominate. While there are some notable examples of how ICT can enable more agile processes in healthcare supply chains (for example Barrington et al. 2010), there is still much that can be done. As mobile phones and mobile network coverage become more ubiquitous in the developing world (for example Lee et al. 2012), the opportunity increases to exploit them to support stock management, stock ordering, vehicle tracking and other supply chain processes.

In addition, there is the opportunity to make use of ICT to improve patient centricity and to deliver additional patient-related services. There are some examples of this in sub-Saharan Africa and elsewhere, such as using SMS messages sent to patients to remind them to take their drugs (Pop-Eleches et al. 2011; Sabate 2003). In sub-Saharan Africa, in line with perceived health priorities, these have primarily focused on HIV/AIDS and associated diseases. Such reminders have been shown to be effective if the patient has the resources required to take the drugs. There may be the potential to automate the setting of alarms and reminders using information linked from drug packaging using an Internet of Things (IoT) approach (Wikipedia 2013; European Union 2013). Other opportunities for using IoT may include controlling daily drug dispensers, recording health indicators either for personal use or for sharing with health staff, and remote patient support. While such ideas have been trialled in the developed world (see Couturier et al. 2012 for a review of experiences), there is scope to research their application and acceptability in the developing world. This would potentially encourage pharmaceutical manufacturers to engage in relevant and visible “beyond the pill” initiatives.

Based on the results of the literature reviews, it would seem that there are opportunities to make more use of ICT in healthcare supply chains, not least in the developing world where mobile communications penetration is widespread. Therefore research into the most effective approaches should identify ways to improve patient care, reduce costs and increase effectiveness.

Implications for business models

There is little agreement on the definition of the term “business model”, but it is considered to incorporate the four themes of strategic choices, the value network, creating value and capturing value (Ng & Briscoe 2012). Ng and Briscoe also indicate that new business models usually occur as a result of either innovation or new technology, to which could also be added new external requirements.

The conclusions from the literature reviews plus the implications listed above indicate that a number of innovations, new technologies and new external requirements are emerging in the healthcare supply chain including:

- Increasing customer centricity, including a desire for improved patient adherence
- Pressure to deliver outcomes
- “Beyond the pill” expectations
- Changes to drug design and/or enhancements through postponement
- Increasing need for supply chain agility
- Closer integration of supply chain partners
- Opportunities for improved use of ICT including mobile technologies and Internet of Things
- Constant pressure on cost and efficiency.

Each of these could therefore have implications on business model design for pharmaceutical manufacturers, for MoHs and for other supply chain partners.

Outcome-based contracts (Ng & Briscoe 2012), focused on outcomes rather than inputs, may be expected in healthcare supply chains before too long (Friend, Arlington, Pisani, et al. 2009). This should lead to pharmaceutical manufacturers working much more closely with the rest of the healthcare supply chain and with regulators. This should in turn lead to improved use of ICT to facilitate enhanced communications along the supply chain, which will also assist with cost reductions while contributing to agility.

Changes to drug design could potentially change business models if they lead to a differentiated approach to supplying the developing world. At present, pharmaceutical manufacturers sell into the developing world what they have already created for mature markets. Therefore if they begin to see the developing world as a major new market that requires different products – as, for example, automotive manufacturers have done for some time – then it could lead to new business divisions as with GSK’s Developing Countries and Market Access operating unit, for example (Learmouth 2011). And as with the automotive industry, it may then lead to developing world products being introduced back into mature markets

to serve appropriate market segments; this so-called “reverse innovation” can be very disruptive to established markets, thus increasing value capture for companies that do this successfully.

The increasing need for improved supply chain agility could see greater use of third-party logistics companies for healthcare supply chains in the developing world. At present, the majority of public sector healthcare supply chain processes are operated in-house by MoHs, with perhaps only central warehousing managed by a third party either as an outsourcing contract or with contract staff (Dowling 2011). It is acknowledged that MoHs are not necessarily best placed to continue this role for the longer term, as a result of skills issues and staff shortages (Brown 2011). Outsourcing of larger sections of the supply chain could therefore potentially improve services while reducing costs. Such an approach could begin to address the 30-year lag in healthcare supply chain practices compared to other industries. Research in this area could be valuable.

Conclusions

It is clear from the analysis in this section that there are indeed implications in the four focus areas. In order to achieve higher patient-centricity, drug design can be enhanced, supply chains can be improved, and ICT can be used more effectively. Business model changes can be expected as a result.

To achieve this it will be necessary to perform research into the issues around patient adherence in the resource-poor environments that predominate in sub-Saharan Africa. This should be the precursor to change, and should inform it.

Overall Conclusions and Recommendations

There are a number of conclusions that can be drawn from the answers to the two questions asked at the start of this report. At a high level, it is clear that healthcare supply chains in the developing world cannot stay as they are if the internal and external pressures on them are to be accommodated. The challenge therefore is to determine in what ways they could or should change.

If healthcare supply chains are to remain true to their aims then the benefits of any changes should be accrued first to the patient. Consumer centricity is an emerging theme of supply chains in general but patients should naturally be at the heart of healthcare supply chains.

On this basis, it is recommended that Service-Dominant Logic-focused research into patient adherence in sub-Saharan Africa should be a starting point. It will determine what patients need that supply chains can deliver, and provide a basis for outcome-based contracts since patient adherence is core to understanding and improving outcomes.

With this information as a base, possible changes can be considered. Some changes will enhance services to patients, such as drug modifications to help improve

patient adherence or the use of IoT concepts for monitoring or reminders. Others will reduce costs or improve effectiveness in the supply chain, but without impacting patients because patient needs will be central to the plans. Examples of these may be increased use of ICT for supply chain knowledge management to enhance agility, supply chain cooperation to support outcome-based contracts, and increased use of outsourcing to reduce costs.

Whatever changes are eventually made, the focus must be the patient. To this end, the question which must first be answered is, why is patient adherence in sub-Saharan Africa so low? From this knowledge, all other changes can flow.

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