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TISSUE EXPERT COMMITTEE:

HOW CAN THE SYSTEM BEST ENSURE THAT SUPPLY IS ALIGNED WITH DEMAND?

(DRAFT SOLUTION DESIGN PAPER)

CONTENTS

1. Scope

HOW CAN THE SYSTEM BEST ENSURE THAT SUPPLY IS ALIGNED WITH DEMAND?

The alignment of supply and demand was a category of current challenges observed in the current state of the Canadian tissue system. Ensuring supply is aligned with demand does not mean that all demand is met, nor does it suggest a certain balance between Canadian supply and foreign supply. Ensuring the aligning of supply with demand within the Canadian tissues system means understanding the quantity and breadth of product demand within the system, optimizing use of Canadian resources (e.g. recovered tissue, processing capacity) and assets (e.g. inventory) to supply the demand, and having mechanisms in place to address (to the extent possible) potential risks and current issues with obtaining the necessary supply (domestically and internationally) to meet the demand.

This paper will primarily focus on exploring various enablers used by systems and organizations to try and ensure alignment of supply with demand: customer relationships, demand forecasting, production flexibility, and inventory management.

While the integral linkage between supply planning and source of supply will be referenced, this document will not address production levels or the balance between Canadian-sourced and foreign-sourced tissue as these topics will be addressed as part of a separate discussion document.

2. Current State

A. Current State

Canada has a competitive and relatively open tissue market in which end-users have the ability to purchase tissue from any supplier that is registered with Health Canada. In general, demand for tissue in Canada is met through this open access to various sources of supply. Although demand for cornea and tendons has been demonstrated to be more difficult to meet (due to cost and other factors), demand for all commonly used tissue types is either available through the Canadian tissue banking system or through importation from Health Canada registered suppliers in the United States. In essence, importation bridges the gap between total demand and Canadian supply both in terms of quantity, type, and breadth of product available.

The challenge is generally not that demand goes unmet, rather that the Canadian tissue system is not currently capable of ensuring, barring uncontrollable circumstances, that demand is met despite risks that may come to fruition. The tissue system as a whole does not have the relationships with end-users necessary to understand the quantity and product attributes demanded, resulting, among other consequences, in an inability to forecast demand on a national level. A general lack of market intelligence and cooperation between jurisdictions has led to an inability to optimally leverage resources through production flexibility. Finally, a general lack of coordination and/or cooperation between tissue banks has led to uncoordinated inventory management that has historically allowed some provinces to suffer shortages of certain tissue types while other provinces suffer from wasted capacity as production for the same tissue type has been scaled back due to surplus inventory. In the following sections this paper will explore these statements of current state in greater depth.

End-User Relationships

Effective end-user relationships, whether through existing distribution channels or otherwise, provide insight into transplant establishment product needs and demands thereby supporting appropriate production and capture of market share. A survey conducted in 2003 found that, at the time, a notable portion of transplant establishments and end-users were unaware of Canadian sources for allograft products.[1]

The 2009 Environmental Scan of the Canadian tissue market revealed the majority of tissue banks focus their distribution within their institution or health region and are not engaged in the development of relationships outside their current scope of practice.[2]

[1] Canadian Council for Donation and Transplantation. Supply of Human Allograft Tissue in Canada; Final Report, April 2003
[2] Canadian Blood Services, 2009 Environmental Scan - Supply of Human Allograft Tissue in Canada: Preliminary Data, 2009

End-user engagement strategies were uncoordinated and bank specific. Interaction with allograft end-users was mostly limited to hallway conversations and very basic customer satisfaction surveys.

An option being pursued by at least one bank is partnering with a medical supply company to gain access to an established set of distribution channel relationships.[3]

Some efforts to engage end-users are happening successfully at a regional or provincial level. The Southern Alberta Tissue Program has taken a more coordinated approach engaging all end-users within their health region in a comprehensive review of demand and product requirements.[4] Hema-Quebec surveyed Quebec transplant establishments to quantify current utilization. No other examples of provincial or national level engagement of transplant establishments or end-users were identified.

Forecasting Demand

Effective demand forecasting provides an informed estimate of short and longer term consumer demand both in terms of breath and quantity of products such that product line, recovery, production, and distribution planning have a basis in market reality.

The 2009 scan did not identify any demand forecast initiatives or processes within Canadian tissue banks. The 2009 Environmental Scan - Pilot Survey involving three Canadian tissue banks asked those banks to work with their operating rooms to quantify total allograft demand (utilization) within their hospitals. The Pilot indicated that two of the three tissue banks/hospitals were unable to readily quantify allograft utilization (demand), an illustration of why accurate demand forecasting would be challenging within the current state.[5]

While Quebec (survey of transplant establishments)[6] and Ontario (extrapolated Canadian Council for Donation and Transplantation data)[7] have employed methodologies to estimate demand on a provincial level, there is no process or activities in place to quantify and or forecast demand for Canada as a whole.

Production Flexibility

Production flexibility refers to the ability to adjust production levels and product lines to respond to emerging technologies and be responsive to end-user demand. There are two basic levers when flexing tissue production: recovered tissue and production capacity and capability.

[3] Canadian Blood Services. Environmental Scan of the Canadian Tissue Community: Interim Report (2009).
[4] Calgary Health Region. Allograft Needs Assessment Report, January 19, 2009.
[5] Canadian Blood Services. 2009 Environmental Scan - Demand for Human Allograft Tissue in Canada: Pilot Survey, 2009
[6] Canadian Council for Donation and Transplantation. Human Tissue Importation Practices in Canada, October 2006.
[7] Canadian Blood Services. Environmental Scan of the Canadian Tissue Community: Interim Report (2009).

The 2009 Environmental Scan revealed minimal ability to adjust production within musculoskeletal, cardiac and skin banks in support of demand and changing clinical needs. Production appears to be a function of donor supply rather then end-user demand. Two programs with established processing facilities (Comprehensive Tissue Centre, Edmonton and the Regional Tissue Bank, Halifax) indicated significant under utilization of these resources due to lack of donor supply.[8]

The scan of the eye bank community revealed the ability to adjust ocular production in support of demand and emerging clinical needs as demonstrated in the rapid evolution of Descemet's stripping with endothelial keratoplasty (DSEK) procedures. A number of jurisdictions exceed their provincial demand and are considering reducing recoveries despite unmet demand on a national level. In jurisdictions where ocular demand exceeds supply, programs indicated their ability to increase production was limited not by a lack of potential donors but by the lack of resources to support recovery teams and transmissible disease testing.

Inventory Management

Inventory management and the supporting information systems are unique to each tissue bank. Inventory is generally viewed as an institutional or regional resource. The majority of tissue banks support only institutional or regional demand. Two programs have focused on the distribution of allografts outside their provinces as a method to generate revenue.

Transplant establishments have no single point of access for Canadian tissue products. The scan revealed no coordinated or systematic approach to control stock levels and distribute inventory provincially or nationally with the exception of Quebec.

This lack of coordination between tissue banks has resulted in a market that allows for inefficient inventory management decisions on a national level. A number of respondents identified situations where production was reduced in one jurisdiction while other areas of the country were experiencing shortfalls.[9] Eye banks seem to be an exception as anecdotal information suggests that there is routine communication of product surpluses to ensure the allocation of inventory to fulfill demand.

Funding

The 2009 scan revealed no coordinated or systematic approach to funding donor supply, production and distribution. Cost recovery practices within tissue programs are inconsistent. The lack of cost recovery practices in ocular programs was identified as a barrier to inventory management. Two programs with surplus ocular tissue indicated they may reduce recovery as they do not receive funding to procure corneas for other provinces.

[8] Canadian Blood Services. Environmental Scan of the Canadian Tissue Community: Interim Report (2009).
[9] Canadian Blood Services. Environmental Scan of the Canadian Tissue Community: Interim Report (2009).

B. Current Community Thinking

I. Reports and Papers

Final Report: Development and Evaluation of Options for Tissue Systems in Canada, 2006[10]

This report assessed previous CCDT reports and consultations as well as international comparators to develop and evaluate options for tissue systems in Canada. The report identified the issues which drive or have the most influence on Canadian tissue banking as well as the outcomes of our current system. Issues explored in the report included the consequences of lacking a national planning process.

Key elements of a successful tissue system model were identified and included:

- development of a national tissue inventory database
- establishment and monitoring of national targets for supply and demand of tissue products
- facilitation of national group purchasing of advanced tissue products
- promotion of a national point of access to tissue for Canadian end-users

II. Forums

Enhancing Tissue Banking in Canada – Phase 1: Sustainability (Canadian Council for Donation and Transplantation)
November 23-24, 2006, Montreal, Quebec

The focus of the meeting was sustainability in tissue banking.[11] Discussion groups identified several strategic actions applicable to supply demand alignment including:

- Develop a strategy to engage transplant establishments and end-users
- Develop a national strategy for managing long term demand and processing of advanced tissue products
- Establish a mechanism for the bulk purchase of external products, starting regionally and moving nationally
- Develop a national processing strategy taking into account regional variations
- Convene evidence based consensus forums to identify best practices to standardization in tissue production and distribution
- Develop a centralized importation/distribution system (not necessarily at the national level)
- Develop a national database (virtual tissue warehouse) including a waiting list
- Establish interprovincial billing agreements for tissue

National Consultation: Organ and Tissue Donation and Transplantation

[10] Canadian Council for Donation and Transplantation. Final Report: Development and Evaluation of Options for Tissue Systems in Canada, March 31, 2006.
[11] Canadian Council for Donation and Transplantation. Enhancing Tissue Banking in Canada, Phase 1: Sustainability, Task Force Report, May 2007

(Canadian Blood Services)
September 22-24, 2008, Gatineau, Quebec
The final output from this consultation developed a number of recommendations in relation to supply demand alignment including:[12]

- Perform a detailed market study to quantify demand, drivers of demand, and user preferences
- Create transplant establishment / end-user advisory groups
- Develop a supply strategy focused on specific tissue types or products
- Implement standardized harmonized product bar coding to support inventory management and traceability
- Implement a nationwide information sharing network between current tissue banks of their existing inventory levels
- Develop a national allocation model for tissues in short supply

C. Other Models

Other health care systems, including tissue donation and transplantation systems, take on a variety of models in order to ensure alignment of supply with demand, or to mitigate the risks that might lead to demand not being met. Generally, these models fall into three categories: sole distributor, coordinated, and competitive.

- In a sole distributor model, product distribution is restricted to a single distributor. Supply and demand are monitored at a system level. Distribution channels and end-user relationships are managed centrally
- In a coordinated model, production and distribution of products are supported by multiple independent source establishments; however, systems and processes are in place to coordinate the alignment of supply and demand
- In a competitive model, production and distribution of products is supported by multiple independent source establishments in a competitive environment. There is no coordinated approach to aligning supply and demand or to allocating scarce tissue

The following systems' approaches to ensuring the alignment of supply and demand are described briefly as an illustration of possible approaches to addressing the central question of this paper.

Australia
Tissue banks are state-based and function independently. The Australian Organ and Tissue Donation and Transplant Authority is developing a National Eye and Tissue Donation and Transplant Network. This network will deliver a coordinated, accountable, national tissue transplantation service and develop the data collection, analysis and reporting requirements including a national eye and tissue donor database, and national

[12] Canadian Blood Services. Executive Summary National Consultation, Organ and Tissue Donation and Transplantation, Ottawa, Ontario September 22-24, 2008

eye and tissue allocation protocols.[13] The Network will also support national eye and tissue donation allocation protocols and processes including a national eye and tissue donor database and outcome registry. As the network is in development, specifics on supply demand components have yet to be determined.

United Kingdom: UK Blood and Transplant System: National Tissue Service

The National Health Blood and Transplant System pursued the centralization and amalgamation of a number of tissue banks within the UK's tissue system thus creating the National Tissue Service (NTS). The NTS competes for market share with other UK tissue banks as well as international tissue sources and recovers its costs through invoicing end-users for allograft use. As the National Tissue Service is a single bank within a competitive environment, a national approach to aligning supply and demand is challenging.

Eye banking is currently managed within NHSBT UK Transplant division, as opposed to the National Tissue Service, due to its historic linkages to the organ donation program.

United States

The alignment of supply and demand in the United States is a consequence of a system that has consistent supply surplus that is exported to other countries around the world. The U.S. tissue system is a competitive, private-sector market. Success at procurement, processing, and distribution activities is dependent on the strength of business relationships developed based on efficacy, cost, and quality of service or product. Tissue procurement agencies generate revenue from the tissue they procure and supply to tissue banks and distributors. Tissue and eye banks and distributors generate revenue from the tissue they process and/or distribute to transplant establishments. Distribution channels are well developed by tissue banks, tissue distributors, and medical supply companies. Significant marketing processes are linked to market capture and transplant establishment / end-user engagement. Appendix A is one research organization's forecast of U.S. demand through 2013.

Allograft processors, in partnership with academia, are at the forefront of allograft research and development including stem cell incorporation and bioengineering. By developing advances in the clinical efficacy of allografts, through research and development, US processers are essentially creating "new demand" and "markets" as clinicians adopt these products as best practice.

Canada: Hema-Quebec

Tissue and tissue products are being centralized provincially within an evolving sole source distribution model. Hema-Quebec, a provincially-funded provider of blood and tissue, successfully piloted a centralized tissue production, importation, and distribution

[13] Australia Government Department of Health and Aging. A Worlds Best Practice Approach to Organ and Tissue Donation for Australia: Overview, Retrieved from www.health.gov.au on August 15, 2009.

model at a hospital in Montreal. Demand and supply are aligned with about one sixth of Quebec's demand being satisfied with imported tissue.

Hema-Quebec has partnered with MTF (Musculoskeletal Transplant Foundation) with the intention of becoming the Quebec distributor for all MTF products. Hema-Quebec is considering partnering with a medical supply company to access an established distribution channel into the Quebec allograft market. The long term goal for Hema-Quebec is to become the sole distributor of allograft products in Quebec.[14]

Canada: Canadian Blood Services (Blood Operations)

Blood and blood products have been centralized nationally through a sole source distribution model. Provinces and territories fund Canadian Blood Services. Blood and its derivatives are viewed as a national resource and distributed accordingly with no fees to end-users. Canadian Blood Services has been able to meet demands for product over 95% of the time using supply held in national inventory.

Hospital liaison specialists are located within centres of significant product utilization to support and manage distribution channels. Information systems support real time inventory management on a national basis with products routinely shipped between jurisdictions to support demand. Demand forecasting models are utilized in both short and long term planning and operations. Supply and demand analysis directs product collection, production, and distribution. Additionally, this analysis is utilized to identify gaps in the alignment of supply and demand that need to be addressed.

[14] Canadian Blood Services (2008). Hema-Quebec Site Visit and Interview, Summary of Key Learnings, February 21,2008

3. Analysis

A. Analysis Approach

Analysis of existing research and opinion papers has been conducted to provide the basis for this document. An environmental scan of the Canadian tissue bank community has been performed to further enhance data considered. This scan included quantitative surveys, site visits, and qualitative interviews.

A pilot survey of Canadian transplant establishments was undertaken to quantify current Canadian demand. Results indicated that data on allograft utilization was not readily available or accessible. As a result, data from a 2003 survey of Canadian end-users was used to provide demand assumptions.

A high level SWOT analysis of current models (domestic, international tissue systems, other health care systems) and related mechanisms was completed. This analysis of the current state was used to evaluate the status quo and potential options.

Assumptions underlying the analysis include:

1. The final decision will have to integrate with the other elements of the Tissue System strategy and more specifically the recommendations from the solution design question regarding the balance of foreign and domestic tissue recovery and processing.
2. Funding agents (e.g., PT governments, RHAs/LHINs, OPOs, etc.) are willing to consider adjustments to current funding and operational approaches.

B. Analysis Findings

- Canadian programs support a significant component of ocular demand
- Canadian programs support only a portion of basic bone, skin and cardiac allograft demand
- Canadian programs do not produce the allografts which comprise the greatest component of demand; demineralized and mineralized products and machined bone products
    - Canadian capability and capacity would need to increase dramatically to supply these types of products
- There is lack of product standardization within Canadian tissue banks

4. Options and Considerations

A. Options

I. What is the best model to support alignment of Canadian supply with demand?

a) Status Quo:

Individual banks continue to supply tissue products independently in a competitive and uncoordinated business environment. There continues to be indications of a lack of demand planning, especially at an aggregate level.

Strengths	Weaknesses
▪ No additional resources required ▪ No change management required ▪ Allows free market principals to govern attributes of supply such as price and vendor selection	▪ Does not ensure alignment between supply and demand across Canada ▪ There is no coordinated long term planning for national demand or coordinated supply risk mitigation ▪ Existing processing capacity is not optimized ▪ Optimal utilization of current inventory is not supported ▪ Focus on supplying institutions or regions does not take advantage of potential economies of scale ▪ No control or ability to manage supply disruption or shortages at the national level

Critical Mechanisms	Presence
End User Relationships	Regional
Demand Forecasting	Regional
Production Flexibility	Regional
Inventory Management	Regional

b) Sole-Source Provincial Distribution:

Provinces centralize the distribution of all tissue produced or imported through a sole source distributor. This option would facilitate the development of provincial distribution channels and demand forecasting. Production flexibility and inventory management would be coordinated through the sole provincial distributor.

Strengths	Weaknesses
▪ In comparison to the status-quo, where tissue banking is predominantly regional, this model would provide: ▪ Greater ability to manage supply distribution or shortages through a larger inventory ▪ Coordinated end-user relationships that provide market intelligence ▪ Greater ability to negotiate favorable pricing on foreign processing and imported tissue ▪ Greater ability to mitigate supply shortfall ▪ Greater opportunities for economies of scale in regards to planning overhead, processing, and inventory ▪ Delivery of service remains within the provincial health system	▪ Access to allografts will not be consistent as Canadian product supply will vary provincially ▪ Demand planning will not occur at a national level without independent aggregation of data ▪ Excess processing capacity may be wasted instead of being used to meet the demand of provinces experiencing a shortfall of product ▪ Shifts in product due to changing needs or advances in technology would be difficult to meet with a coordinated response ▪ Excess inventory in one province may not be used to meet the needs of provinces experiencing a shortfall in product ▪ Product diversity available is set provincially, constraining the availability of specialty products
Barriers	
▪ Transplant establishments and end-users enjoy control of their supply through market choices and may have concerns with the loss of this control to a sole distributor ▪ Existing tissue banks have evolved mostly in response to institutional demand and may be uncomfortable transitioning to a more forward-looking approach ▪ Resources would be required to centralize (at least virtually) regional tissue banks into a tissue bank in each province with provincial scope	

Critical Mechanisms	Presence
End User Relationships	Exclusively Provincial
Demand Forecasting	Exclusively Provincial
Production Flexibility	Exclusively Provincial
Inventory Management	Exclusively Provincial

c) Centralized Provincial Distribution w/ Open Market:

Provinces centralize the distribution of tissue they produce and compete for market share with external producers (e.g. other provinces and the U.S.). The central distributor would develop provincial distribution channels and forecast demand provincially. Production flexibility and inventory management would be coordinated through the central distributor.

Strengths	Weaknesses
▪ Allows free market principles to govern attributes of supply such as price, diversity of available product, and vendor selection ▪ The competitive environment may engender enhanced product development within Canadian supply ▪ Provides provincial tissue banks advantages over the current regional tissue banking state including broader market intelligence and end-user relationships, greater economies of scale, greater ability to respond to supply risks, and greater ability to flex production to align with demand	▪ Effectiveness and/or efficiency of the provincial banks in market intelligence, forecasting, flexing production, and managing inventory will be diminished by open market factors ▪ Demand planning will not occur at a national level without independent aggregation of data ▪ Excess processing capacity may be wasted instead of being used to meet the demand of provinces experiencing a shortfall of product ▪ Shifts in product due to changing needs or advances in technology would be difficult to meet with a coordinated response ▪ Excess inventory in one province may not be used to meet the needs of provinces experiencing a shortfall in product
Barriers	
▪ Existing tissue banks have evolved mostly in response to institutional demand and may be challenged by the culture of a more systematic approach ▪ Resources would be required to centralize (at least virtually) regional tissue banks into a tissue bank in each province with provincial scope	

Critical Mechanisms	Presence
End User Relationships	Provincial
Demand Forecasting	Provincial
Production Flexibility	Provincial
Inventory Management	Provincial

d) Sole-Source Canadian Distribution:

Centralize the production and distribution of all tissue produced or imported through a sole Canadian source. The sole distributor would develop national distribution channels and forecast demand on a national level. Production flexibility and inventory management would be coordinated across Canada.

Strengths	Weaknesses
▪ Ability to manage supply disruption or shortages would occur with the broadest inventory possible ▪ Nationally centralized distribution channel relationships provide market intelligence to forecast Canadian demand ▪ Ability to conduct long term planning and risk mitigation at a national level ▪ Realizes the greatest potential for economies of scale in regards to planning overhead, processing, and inventory ▪ Standardization of at least domestic products to centrally managed specifications ▪ Greatest buying power with which to negotiate favorable pricing on imported tissue and foreign processing contracts	▪ Product diversity available is set across Canada, constraining the availability of specialty products

Barriers
▪ Transplant establishments and end-users enjoy control of their supply through market choices and may have concerns in the loss of this control to a sole distributor ▪ Infrastructure investment would be required to centralize (at least virtually) mechanisms for ensuring alignment of supply and demand ▪ Existing services are funded and delivered provincially; the funding for tissue services would need to change to fit this option

Critical Mechanisms	Presence
End User Relationships	Exclusively National
Demand Forecasting	Exclusively National
Production Flexibility	Exclusively National
Inventory Management	Exclusively National

e) Coordinated National Distribution:

This option would coordinate the production and distribution of Canadian tissue through a virtual national inventory. Tissue banks would still compete for market share with international producers. National demand forecasting and coordinating the use of excess processing capacity would be the responsibility of the coordinating body. Financial exchanges between source and transplant establishments would occur on a cost recovery basis. The use of excess processing capacity would be funded by the tissue bank receiving the processed tissue. Inter-provincial partnerships in support of processing and distribution efficiencies would be pursued independently.

Strengths	Weaknesses
▪ No change to independent status of programs ▪ Allows free market principals to govern attributes of supply such as price, diversity of available product, and vendor selection ▪ Allows for the alignment of domestic supply to end-user demand on a national scale ▪ Aggregate data on inventory and production allows for supply / demand planning and supply risk mitigation at a national level	▪ Coordinating use of excess processing capacity within a network of independent banks may be logistically challenging and may not be optimal compared to national coordination of processing ▪ Lack of standardization of product attributes presents a challenge to distributing inventory inter-provincially ▪ Does not optimize the potential for economies of scale as production, storage, and distribution activities are duplicated throughout existing banks
Barriers	
▪ Infrastructure investment would be required to centralize (at least virtually) mechanisms for ensuring alignment of supply and demand ▪ Existing services are funded and delivered provincially; the funding for tissue services would need to change to fit this option ▪ Existing tissue banks have evolved mostly in response to institutional demand and may be uncomfortable transitioning to a more forward-looking approach	

Critical Mechanisms	Presence
End User Relationships	National
Demand Forecasting	National
Production Flexibility	National
Inventory Management	National

B. Considerations

- To achieve the goal of ensuring the alignment of supply and demand across Canada will require certain coordinated mechanisms
- Recommendations may differ by tissue type (e.g. ocular versus bone)
- End-user relationship recommendations may differ by transplant establishment type (e.g. surgical versus dental)
- Detailed business cases may be required to model the cost of any given option

APPENDIX A

The following chart details demand forecasting for the US and are provided as a reference.[a]

Global Orthobiologics Market ($ Millions)

Category	2007	2008	2013	Growth Rate%
Allograft	750	826	1,050	4.95
Growth factors	750	920	1,550	11.0%
Demineralized bone matrix	400	484	780	10.0&
Synthetics (bone substitutes)	400	502	880	11.9%
Blood based and orthopedic stem cells	200	245	414	11.0%
Total	2,500	2,977	4,674	9.4%

US Sales of Bone Allografts by Type, Through 2013 ($ Millions)

Category	2007	2008	2013	Growth Rate%
Base Tissue	375	414	529	5.0%
Machined Implants	200	245	368	8.5%
Demineralized Bone	200	230	407	12.1%
Total	775	889	1,304	8.0%

US Corneal Transplant Market Through 2013

Category	2007	2008	2013	Growth Rate%
Number of Transplants	39,391	40,900	45,000	1.9%
US Market ($Millions)	906	1,006	1,310	5.4%

US Heart Valve Transplant Market Through 2013

Category	2007	2008	2013	Growth Rate%
US Allograft Market	1,100	1,217	1,570	5.2%
US Total Grafts ($Millions)	2,700	2,950	3,680	4.5%

US Market of Human Skin-Based Products Though 2013 ($ Millions)*

Category	2007	2008	2013	Growth Rate%
Human Skin Based Products	188	280	750	21.8%

[a] Based on data from the National Centre for Health Statistics and the American Society for Aesthetic Plastic Surgery