Objective measuring tools for general food safety in Belgium: the barometers of the safety of the food chain

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Introduction

Last decade major changes concerning the management of safety of the food chain in Belgium

- Business plan of FASFC identified the need to measure and monitor overall level of food safety
- Advisory Committee of FASFC reflected on the impact of efforts taken by stakeholders to assure food safety
Introduction

Also to situate within current time frame/trend of using indicators, score systems, measurable objectives, etc, …

Approach

• Working group of Scientific Committee (WG SciCom) activated (April 2009) & Working group meetings
• Consultation of SciCom / FASFC Management / Advisory Committee of FASFC
• Data collection to construct “food safety barometer”

• Advice 28 - 2010 of the SciCom FASFC on concept of tool to measure food safety
  (www.favv-afsca.fgov.be/scientificcommittee/advises/)
Publication and implementation

- Presentation of a tool to measure food safety on the international symposium on Measuring Food Safety and comparing self checking systems (http://www.favv.be/selfcheckingsystems/17/11/2010)

- Scientific paper in Food Research International 44 (2011) 940–950


Concept – Measuring food safety

- Pressure – State – Response concept
- Developed in 1980’s by OECD to classify environmental indicators

FASFC ‘scope is Safety of the Food Chain

3 aspects = 3 barometers
Concept – Measuring food safety

"Barometer"

State

Measure of status for “food safety” during the selected time period of measuring. Information on status is systematically collected by control activities of FASFC.

Pressure

Pressures exerted by general forces, processes or mechanisms operating within society and which impact the food chain and may possibly modify its state (and its food safety).
Response

Refers to preventive and corrective measures that are taken by respective stakeholders within the food chain to react to pressure on the food chain, as well to the overall safety status, in order to maintain or improve its safety.

Concept – Measuring food safety

Pressure

State

Response

3 Tools to Measure

State: three barometers ‘food safety’, ‘plant health’, ‘animal health'
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Case study – state
“Barometer Food Safety”

Step 1 : Definition scope “Food Safety”

- Food and Health: nutritional aspects
  - Energy-intake (eg. obesitas)
  - Nutritional composition (eg. cardio-vascuilar diseases?)
  - Healthy diet (eg. cancer prevention?)
  - ...

- Food safety
  - Biological hazards
  - Chemical hazards
  - Physical hazards
Step 2: Selection of food safety indicators

- Quantitative measurement
- Available in databases of FASFC
- Direct or indirect relation with food safety
- NOT complete picture of all hazards in the food chain & NOT risk assessment

Selection of set of indicators to provide information on the overall situation of food safety

Selection of food safety indicators

Set of 30 Food safety indicators (FSI’s)

- Throughout the food chain (“farm to fork”)
- Belgian production chain, intracommunity trade & import of third countries
- Animal and plant production / products
- Product controls (biological & chemical hazards)
- Process controls (inspections)
- Preventive approach (self-checking systems, notification, traceability)
- Public health issues (restricted to foodborne diseases by biological hazards)
Selection of food safety indicators

- Preventive approach: Notification by stakeholders

FSI1: Notification

FSI2: SCS suppliers primary production

FSI3: SCS primary production

FSI4: SCS processing

FSI5: SCS Collectivities

Selection of food safety indicators

- Preventive approach: Self-checking systems
Selection of food safety indicators

• Proces control: Inspections by FASFC

FSI6: Inspections self-checking systems

FSI7: Inspections infrastructure, hygiene in hotels, restaurants, catering, collectivities & retail & distribution

FSI8: Inspections traceability

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Selection of food safety indicators

• Product controls: Chemical hazards

FSI9: Residues of pesticides in fresh produce (BE origin)

FSI10: Acrylamide

FSI11: Pb & Cd in fresh produce

FSI12: aflatoxins and DON

Plant production / products

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Selection of food safety indicators

• Product controls: Chemical hazards

- FSI13: Unauthorized substances & veterinary drugs used in cows and pigs
- FSI14: Sulfite in minced meat
- VVI15: Dioxins & DL-PCB’s in dairy and eggs
- VVI16: Hg in fish, molluscs, crustaceans
- FSI17: Residues of pesticides in fresh produce (EU and third countries)
- FSI20: Dioxins & DL-PCB’s in feed
- FSI19: Imported animal products for human consumption (border controls)
- FSI12: Aflatoxins and DON
- FSI18: Unauthorised colorants
- FSI21: Contact-materials
Selection of food safety indicators

- **Product controls: Biological hazards**

  - VVI22: *Salmonella* spp. in meat pigs
  - VVI24: *Salmonella* spp. in carcasses and cut meat
  - VVI23: *Salmonella* spp. in layer hens
  - VVI25: *E. coli* in carcasses and cut meat
  - VVI26: *E. coli* in foods
  - VVI27: *L. monocytogenes* in foods

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Selection of food safety indicators

- **Public health**

  - FSI28: Food borne outbreaks
  - FSI29: Salmonellosis
  - FSI30: Listeriosis
### Selection of food safety indicators

**Set of 30 indicators from “farm to fork”**

<table>
<thead>
<tr>
<th>Part in the Food Chain</th>
<th>Number of FSI’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suppliers to the food chain</td>
<td>7</td>
</tr>
<tr>
<td>Primary plant production</td>
<td>10</td>
</tr>
<tr>
<td>Primary animal production</td>
<td>14</td>
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<tr>
<td>Processing</td>
<td>15</td>
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<td>Distribution</td>
<td>12</td>
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<td>Consumer</td>
<td>3</td>
</tr>
<tr>
<td>Import</td>
<td>8</td>
</tr>
<tr>
<td>Storage &amp; transport</td>
<td>7</td>
</tr>
<tr>
<td>Services &amp; contract work</td>
<td>2</td>
</tr>
</tbody>
</table>

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### Step 3 : Measurement of food safety

2007-2011

**Inspections by FASFC**

- % OK or OK with remarks
- Inspections self checking
- Inspections hygiene
- Inspections traceability

- 2007
- 2008
- 2009
- 2010
- 2011
Step 4 : Prioritization of the 30 indicators in their impact to measure food safety
- perceived by various stakeholders

- assigning a weight to each indicator by expert opinion:
  SciCom & Advisory Com & Dir Com FASFC

- using Las Vegas method :
  -assigning 20 chips to 30 indicators
  -multiple chips/indicator – total 20 chips

Prioritization of Food safety indicators
10 indicators with highest (perceived) relevance

- FSI6: Inspections self checking in the food chain 2,06
- FSI17: Inspections infrastructure, hygiene in the sectors of distribution, hotels and catering and community kitchens 1,88
- FSI19: Chemical and microbiological hazards in imported animal products intended for human consumption 1,73
- FSI18: Inspections traceability within the food chain 1,65
- FSI13: Substances with an anabolic action, unauthorized substances and veterinary drugs for cows and pigs 1,50
- FSI28: Foodborne outbreaks 1,46
- FSI17: Residues from pesticides in vegetables and fruit from other EU-countries and third countries 1,39
- FSI29: Salmonellosis in humans 1,28
- FSI1: Compulsory notification in food safety 1,16
- FSI4: Self checking systems in the transformation sector 1,16
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Prioritization of Food safety indicators

10 indicators with lowest (perceived) relevance

- FS13: Self checking systems in the primary production sector  0,71
- FS126: **E. coli** in foodstuffs  0,71
- FS125: **E. coli** in carcasses and cut meat  0,68
- FS121: Contact materials  0,64
- FS116: Mercury in mollusks, crustaceans and fish  0,53
- FS118: Forbidden colorants  0,53
- FS122: *Salmonella* sp. in meat pigs  0,49
- FS123: *Salmonella* sp. in layer hens  0,49
- FS110: Acrylamide  0,41
- FS114: Sulfite in minced meat  0,38

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### Food Safety Indicators: from 2007 to 2011

<table>
<thead>
<tr>
<th>FSI</th>
<th>Title</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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<tbody>
<tr>
<td>FS1</td>
<td>Notifications</td>
<td>365</td>
<td>365</td>
<td>356</td>
<td>356</td>
<td>1,16</td>
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<tr>
<td>FS2</td>
<td>Self checking supply sector for primary production</td>
<td>43,6%</td>
<td>53,3%</td>
<td>68,3%</td>
<td>49,8%</td>
<td>50,7%</td>
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<td>FS3</td>
<td>Self checking primary production</td>
<td>6,2%</td>
<td>11,7%</td>
<td>11,2%</td>
<td>31,6%</td>
<td>39,6%</td>
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<tr>
<td>FS4</td>
<td>Self checking community kitchen sector</td>
<td>0,6%</td>
<td>1,8%</td>
<td>5,7%</td>
<td>6,9%</td>
<td>10,1%</td>
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<tr>
<td>FS5</td>
<td>Self checking community kitchen sector</td>
<td>0,0%</td>
<td>0,1%</td>
<td>0,4%</td>
<td>0,6%</td>
<td>1,0%</td>
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<tr>
<td>FS6</td>
<td>Inspections hygiene</td>
<td>73,1%</td>
<td>62,2%</td>
<td>55,6%</td>
<td>53,1%</td>
<td>59,8%</td>
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<td>FS7</td>
<td>J. monocystis</td>
<td>77,8%</td>
<td>56,0%</td>
<td>56,0%</td>
<td>51,8%</td>
<td>54,1%</td>
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<tr>
<td>FS8</td>
<td>Inspections inadmissibility</td>
<td>93,9%</td>
<td>94,7%</td>
<td>95,3%</td>
<td>94,8%</td>
<td>94,8%</td>
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<tr>
<td>FS9</td>
<td>Pesticides in Belgian products</td>
<td>94,2%</td>
<td>93,3%</td>
<td>95,5%</td>
<td>94,0%</td>
<td>94,0%</td>
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<td>FS10</td>
<td>Acrylamide</td>
<td>91,6%</td>
<td>85,0%</td>
<td>91,3%</td>
<td>93,0%</td>
<td>94,5%</td>
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<td>FS11</td>
<td>Pb and Cd in vegetables &amp; fruit</td>
<td>100,0%</td>
<td>100,0%</td>
<td>100,0%</td>
<td>98,8%</td>
<td>98,1%</td>
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<tr>
<td>FS12</td>
<td>Alfatoxin &amp; DON</td>
<td>99,3%</td>
<td>99,7%</td>
<td>99,7%</td>
<td>99,5%</td>
<td>100,0%</td>
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<tr>
<td>FS13</td>
<td>Unauthorized substances and veterinary drugs</td>
<td>99,8%</td>
<td>99,9%</td>
<td>99,3%</td>
<td>99,3%</td>
<td>100,0%</td>
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<tr>
<td>FS14</td>
<td>Sulfite in minced meat</td>
<td>94,0%</td>
<td>91,1%</td>
<td>93,3%</td>
<td>96,9%</td>
<td>97,2%</td>
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<tr>
<td>FS15</td>
<td>Dioxins and DL PDBs in dairy products &amp; eggs</td>
<td>99,5%</td>
<td>99,2%</td>
<td>100,0%</td>
<td>100,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>FS16</td>
<td>Hp in mollusks, crustaceans &amp; fish</td>
<td>100,0%</td>
<td>100,0%</td>
<td>100,0%</td>
<td>99,5%</td>
<td>99,1%</td>
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<tr>
<td>FS17</td>
<td>Pesticides in imported products</td>
<td>91,2%</td>
<td>92,3%</td>
<td>93,1%</td>
<td>94,0%</td>
<td>93,4%</td>
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<tr>
<td>FS18</td>
<td>Forbidden colorants</td>
<td>100,0%</td>
<td>100,0%</td>
<td>100,0%</td>
<td>99,7%</td>
<td>99,7%</td>
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<tr>
<td>FS19</td>
<td>Imported animal products</td>
<td>98,3%</td>
<td>99,0%</td>
<td>98,6%</td>
<td>97,3%</td>
<td>97,3%</td>
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<tr>
<td>FS20</td>
<td>Dioxins and DL PDBs in animal fodder</td>
<td>99,2%</td>
<td>100,0%</td>
<td>100,0%</td>
<td>99,8%</td>
<td>99,8%</td>
</tr>
<tr>
<td>FS21</td>
<td>Contact materials</td>
<td>95,7%</td>
<td>95,8%</td>
<td>96,3%</td>
<td>96,7%</td>
<td>97,7%</td>
</tr>
<tr>
<td>FS22</td>
<td><em>Salmonella</em> sp. in meat pigs</td>
<td>96,1%</td>
<td>95,3%</td>
<td>95,1%</td>
<td>97,8%</td>
<td>98,1%</td>
</tr>
<tr>
<td>FS23</td>
<td><em>Salmonella</em> sp. in layer hens</td>
<td>94,7%</td>
<td>91,8%</td>
<td>94,4%</td>
<td>94,1%</td>
<td>96,1%</td>
</tr>
<tr>
<td>FS24</td>
<td><em>Salmonella</em> sp. in poultry and pig</td>
<td>88,6%</td>
<td>89,8%</td>
<td>86,5%</td>
<td>89,7%</td>
<td>91,7%</td>
</tr>
<tr>
<td>FS25</td>
<td><em>E. coli</em> in carcasses &amp; cut meat</td>
<td>93,9%</td>
<td>95,0%</td>
<td>88,0%</td>
<td>93,9%</td>
<td>93,1%</td>
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<tr>
<td>FS26</td>
<td><em>E. coli</em> in foodstuffs</td>
<td>95,5%</td>
<td>97,6%</td>
<td>97,8%</td>
<td>97,3%</td>
<td>97,7%</td>
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<tr>
<td>FS27</td>
<td>J. monocystis</td>
<td>98,3%</td>
<td>98,3%</td>
<td>98,7%</td>
<td>98,0%</td>
<td>99,0%</td>
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<tr>
<td>FS28</td>
<td>Foodborne outbreaks</td>
<td>8,6</td>
<td>5,4</td>
<td>7,9</td>
<td>12,4</td>
<td>14,1</td>
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<tr>
<td>FS29</td>
<td><em>Salmonella</em></td>
<td>37,6</td>
<td>27,0</td>
<td>29,0</td>
<td>33,8</td>
<td>39,3</td>
</tr>
<tr>
<td>FS30</td>
<td>Listeriosis</td>
<td>0,5</td>
<td>0,6</td>
<td>0,7</td>
<td>0,4</td>
<td>0,6</td>
</tr>
</tbody>
</table>

### Factors

<table>
<thead>
<tr>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,7%</td>
<td>11,9%</td>
<td>7,5%</td>
<td>11,6%</td>
<td>5,6%</td>
</tr>
</tbody>
</table>
State: 2008 versus 2007

Status of Food Safety + 0.11%

State: 2009 versus 2008

Status of Food Safety + 11.26%

(2.37% if not SCS processing taken into account cfr. 2008 tov 2007)
State: 2010 versus 2009

Status of Food Safety

+ 3.73%

State: 2011 versus 2010

Status of Food Safety

+ 1.82%

Belgian Federal Agency for the Safety of the Food Chain
Food Safety Barometer

Further follow-up

The top 4 pressures

- Economic
  - financial crisis /limitation of resources
  - price of raw materials
- Political
  - complexity of legislation
- Social
  - media and perception of food safety
  - eating habits

Responses: five main strategies

- Communication and networking
- Training
- Participation in working groups and elaboration of research programs
- Legislation, control and monitoring plans by government
- No or limited response
  - In general, the link of a specific response to a specific perceived pressure was difficult to demonstrate
Conclusions

– **Measuring Food Safety is a complex**: need for 30 food safety indicators!
– **Indicators → General Food Law** (integrated systematic approach from “from farm to fork” to assure food safety)
– **Product controls**: various indicators show a **high level of food safety** (>95% compliance)
– Results of **inspection**: prone to improvements
– **Certified self checking systems** have a **positive influence** on food safety barometer
– Overall **trend to improvement of food safety** to follow-up in coming years

Lessons to be learnt

• Food safety barometer = to communicate in an intelligible, comprehensible manner to stakeholders
• Food safety indicators = basis for trend analysis – to set in due time quantitative objectives?
• Food safety barometer
  = helicopter view, may trigger further study
  = links to function of control agency & acceptation by operators & general public
  – Complementary to annual report
  – Complementary to risk assessment (hazard/commodity)
Further reading

Measuring the safety of the food chain in Belgium: Development of a barometer
Kathleen Baert 1, Xavier Van Huffel 2,*, Olivier Wilmart 1, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bengo

Measuring the perceived pressure and stakeholders' response that may impact the status of the safety of the food chain in Belgium
Kathleen Baert 1, Xavier Van Huffel 2,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bervoets 1,*, Herman Diricks 1, André Hoylaerts 1,*, Breke De Smedt 1,*, Liesbeth Jacxsens 2,*, Dirk Bengo

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- Advisory Committee of FASFC