

# Personalized Nutrition

## Arnold Gloor

Director Personalized Nutrition, Medudem AG,  
Zurich, Switzerland

### Key messages

- > Awareness of the impact of nutrition on health status is constantly increasing.
- > Personalized nutrition offers approaches to tackle both undernutrition and obesity.
- > Investments in digital connectivity are needed to make the delivery of personalized nutrition possible.

Awareness of the impact of nutrition on health status is constantly increasing. This trend has created a growing diversity in attitudes towards food in high-income countries (HICs). Consumers are overwhelmed by the information provided by literature of all kinds, as well as the content made available via social media. Food companies, restaurants and retailers have diversified their portfolios and adapted to the new demands for vegetarian, vegan and organic food, and for foods that take account of food intolerances and health-related trends.

## “Consumers are recognizing the link between healthy food intake and the prevention of disease”

Consumers are recognizing the link between healthy food intake and the prevention of disease. Alarm bells are ringing across the globe to signal that much more needs to be done to counter the spread of noncommunicable diet-related diseases such as type 2 diabetes and cardiovascular disease. The burden on health systems is continually increasing. In non-OECD (Organization for Economic Co-operation and Development) countries, health care costs are expected to rise from 2.4% to between 3.1%

and 3.4% of GDP, which is comparable to 50% to 70% of the level expended in OECD countries.<sup>1</sup> Political actors are more and more challenged to find solutions to these problems.

### The twofold challenge

Currently, 2 billion people are overweight or obese,<sup>2</sup> while 2 billion of the world's population still suffers from micronutrient deficiencies (hidden hunger), 40% of women of reproductive age have anemia, and 17% of preschool children are underweight.<sup>3</sup>

The rise in obesity levels in the low-income countries (LICs) largely follows the same patterns as in high-income countries and is caused by the same poor dietary habits. The incidence of type 2 diabetes and cardiovascular disease is rapidly increasing as a consequence.

In the case of hidden hunger caused by micronutrient deficiency, the engagement of stakeholders such as governments and industry is critical to establish a sustainable supply of high-quality food and a clean environment that can improve the average nutritional status of the individual. Individuals in this environment lack the power to significantly improve their personal situation, and are thus highly vulnerable.

In the case of obesity, the individual inhabits an environment that provides sufficient food and generally also food of sufficient quality, but which also contains foods that can have an adverse impact on health. The individual is challenged to make the right choices and must resist the temptation to make bad ones. Personal habits, traditions, behaviors adopted from parents, levels of knowledge about food and food preparation, and awareness of the impact of food on health strongly influence individual choices here.

There are, of course, zones also in HICs where fresh fruits and vegetables are poorly distributed and only available far away from where people live.

When accessibility and security of food supply are the dominating factors for raising the average nutritional status to an acceptable level, investments in general measures such as food fortification and improving the general food supply are more effective. But these measures appear not to be effective in counteracting the bad habits that put people at risk of obesity. Changing personal dietary habits is a big topic in personalized nutrition, and it is one of the key factors in successful interventions. The relevant literature is full of the struggle to overcome

**TABLE 1:** Nine models of personalized nutrition seen in middle- and high-income countries<sup>4</sup>

<b>1. Employee lifestyle guidance</b>	Employers offering lifestyle advice program to employees. The key value proposition focuses on a shared responsibility between the employee and the employer for a healthy lifestyle relevant to employee wellbeing and productivity. Key activity is feedback of lifestyle plan based on individual information and diagnostic data to employees. Customer relationships are established by a one-to-one partnership with the client to build employee satisfaction and performance.
<b>2. Standing strong together</b>	The key value proposition of this model is to enhance healthy lifestyle improvement through social support rather than individual struggle. Social support and even a certain level of peer pressure are adopted to increase self-control and compliance with health advice. Key activities are the organization of social reinforcement networks for improving health (most often weight loss) and the production and distribution of health foods (most often slimming products).
<b>3. Health club</b>	The key value proposition in this model is like that of 'standing strong together', but with a more balanced focus between individual responsibility and institutional support, with a lower level of peer pressure and social support. It is typically based on a broader range of lifestyle changes required for weight management, appearance, or fitness. Key activities are the maintenance of training facilities, coaching in physical training programs, including dietary intake advice, and product sales (e.g., supplements, training gear).
<b>4. Do-it-yourself-healthy-diets</b>	The value proposition in this model is of a more distant nature, often Internet-based. The model provides a diagnostic tool based on individual dietary intake data coupled with tailored dietary advice. However, the initiative and follow-up are left entirely to the consumer. The channel used is the Internet, there are few follow-up options, and the target group comprises individuals who occasionally want to improve their food choices.
<b>5. Step in, step out</b>	This model takes the 'do-it-yourself-healthy-diets' model one step further to include non-invasive phenotypic information in addition to dietary intake data. Key activities are gathering information on dietary intake from the individual, as well as self-reported phenotypic parameters, providing dietary advice and optional feedback based on monitored progress. The mostly used channel is the Internet, but face-to-face contact or telephone sessions are also possible.
<b>6. Test and run to the finish</b>	This model takes the 'step in, step out' model one stage further by providing the consumer with relevant feedback on progress towards health improvement on relevant biomarkers, both non-invasive and invasive phenotypic measures. The key feature is an iterative feedback loop that assures follow-up of the consumer's progress and the possibility to adjust the dietary advice accordingly.
<b>7. All-in lifestyle guidance</b>	This business model extends the 'test and run to the finish' in two directions. It includes genotypic information next to dietary intake data and phenotypic information both as a source of personalized advice and as a monitoring for goal approach. The personalized advice is also broader in scope: it includes other lifestyle changes besides dietary improvement such as activity level or stress/time management. The key feature is the inclusion of genetic information as well.
<b>8. Face-to-face</b>	This business model is close to that of traditional dietician's advisory services. The value proposition is that of personal contact and guidance in face-to-face personalized advice based on dietary intake data. The key feature is the type of customer relationship-building, which is an individual real-life situation. The target group comprises individuals who are diagnosed as requiring some form of dietary guidance (e.g. diabetics, food-allergic patients).
<b>9. We told you so</b>	This business model represents the traditional information-based approach to improving lifestyle following the 'explain and prescribe' dogma. Many governmental organizations follow this approach as a part of nutrition education programs on lifestyle changes with a view to improving public health. It is predicated on mass-media communication channels and, increasingly, Internet-based communication. There is some (target population) advice, but only limited personalization involved, based on dietary intake data alone and with no personal contact. A key distinguishing feature is that the source of the (personalized) nutrition advice is a non-profit organization, which may increase its trustworthiness.

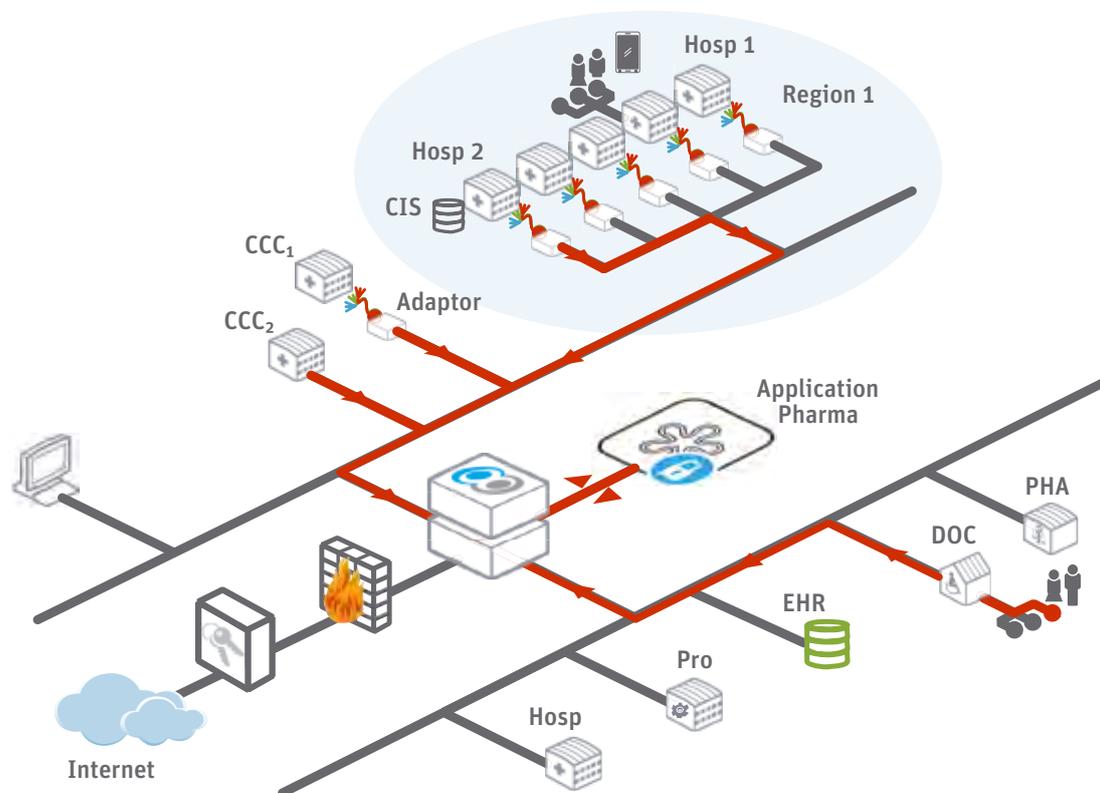
consumers' resistance to change. Investing in personalized nutrition concepts may be an option to improve the health status of this consumer segment in low- and middle-income countries (LMICs).

Different consumer segments have different dynamics. The segment of healthy-agers in Western countries is growing. This segment is willing to invest significant discretionary spending in their personal health and is therefore an attractive target group for all kinds of companies offering services in the personalized nutrition space. In addition, other payers such as health insurance companies are starting to invest in prevention.

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**“Mobile-based technologies offer plenty of options for designers of services”**  
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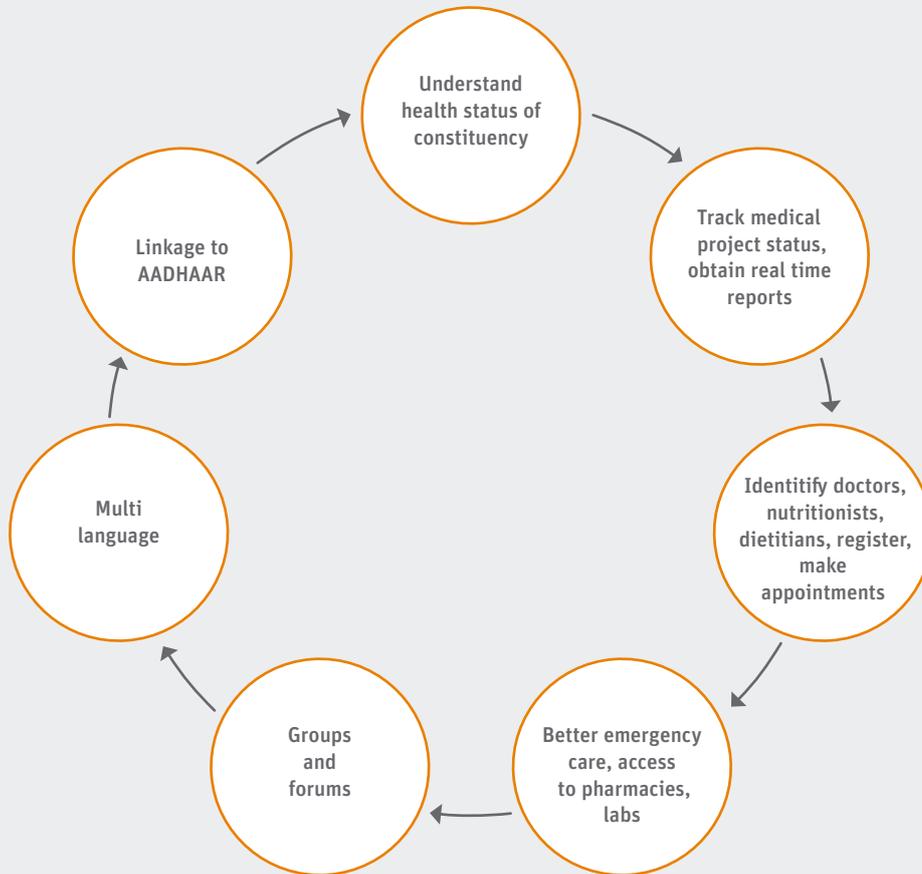
The capabilities of mobile-based technology offer plenty of options for designers of services to choose appropriate business models and vehicles to reach and retain targeted consumer segments, although the characterization of the various consumer segments is still incomplete. Service providers are very much in trial-and-error mode in this emerging area of personalized nutrition. We therefore find many applications and business models that personalize counseling and behavior change using age, gender, BMI (body mass index), dietary intake data, and phenotypic information such as blood pressure, body fat, waist-to-hip ratio, cholesterol, and so forth. Such personalized offers include personal diet plans, shopping lists, lifestyle advice and personal coaching. A recent study<sup>4</sup> sets out to review and categorize existing business model proposals. This study summarizes nine different models in the marketplace covering middle- and high-income countries such as India, USA, UK, Netherlands, New Zealand and Belgium, where consumers either want to lose weight or want a healthier lifestyle (Table 1).

**FIGURE 1:** The Care Integrator platform connects multiple service providers, including nutritionists, around the needs of the consumer.



**Legend:** HOSP: Hospital that connects to patients; ADAPTOR: Interface between clinic information system and Careintegrator; PHA: Pharmacy; EHR: Electronic health record; PRO: Health insurers, service providers, pharma companies; DOC: Doctor's office that connects to patients; CIS: Clinic information system; APPLICATION PHARMA: Tailor-made applications for the pharma industry compliant with data protection legislation using anonymized data sets.

**FIGURE 2:** Paripal’s virtuous cycle of personalized advisory platform for low income groups in India



**Note:** AADHAAR is a unique identity number given to all Indian residents. Paripal is an integrated platform designed to provide affordable services for low income groups and can be used by hospitals, clinics or NGOs.

Platforms connecting multiple stakeholders such as HCPs (health care providers), nutritionists, hospitals, insurers, operators of electronic health records and other service providers around consumers and/or patients offer possibilities to deploy suitable business models via these platforms. Some of these platforms also address needs of consumers at the base of the income pyramid. Careintegrator<sup>5</sup> (Figure 1) and Paripal<sup>6</sup> (Figure 2) are just two of many such examples.

In LMICs, the ratio of out-of-pocket spending to spending by insurers or public programs is relatively high, but this money is spent on basic health services, as these are not sufficiently covered by insurers. Additional discretionary funds are simply not available, and therefore no spending on personalized nutrition is expected. Consumers will probably not themselves create demand for personalized nutrition services. Some of the business models or their variations mentioned in the study may also be suitable for LMICs. It remains to be seen, however, whether other business models will emerge.

**Preparing the ground**

Other new trends in LMICs, however, may prepare the ground for personalized nutrition and diagnostics concepts.

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**“Rwanda is firmly dedicated to seize the chances of the digital revolution”**  
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One trend is the strong intention of some LMICs to jump into the digital future by investing in connectivity and digitalization. Examples are Rwanda and India. President Kagame of Rwanda has started a program to establish a broadband network infrastructure and an industry based around digital services. He sees a great opportunity for Rwanda and for the rest of Africa here, observing: “In Africa we have missed the agricultural and the industrial revolution. Rwanda is firmly dedicated to seize the

chances of the digital revolution.” India likewise is strategically investing in a powerful broadband infrastructure. An Indian IT industry is already established and growing. In the health care sector, too, India is pushing for smart hospitals that embrace the digital future.

These investments in connectivity will trigger many new trends in LMICs. Connectivity is the vehicle that delivers services to areas with a low density of health care infrastructure and health care professionals. It will encourage local entrepreneurs to develop digital services tailored to the needs of the local population. Local companies will develop products and services around prevention and nutrition. This is an opportunity for these countries to create their own industries around digital services.

The quality of these new services will empower informal health care givers (IHCGs) such as non-professionals, family members and volunteers to provide many services that were previously reserved for professional health care givers and were only available at a point-of-care location. People will receive support in their village without needing to travel long distances and will be able to organize health care locally, empowered and supported by remotely accessible services.

Diagnostic technologies are evolving at a tremendous speed. The cost of sensors and of analytical devices that deliver accurate data is shrinking by significant orders of magnitude. Their use will become easy and convenient in the course of time. Diagnostic data can be generated locally and uploaded.

Science around nutrition will become cheaper, and it will become affordable for countries to invest in it locally. It will be easier to establish centers of excellence in LMICs. Scientific work carried out locally will consider local environmental and genetic aspects more effectively. With increased connectivity, just a few centers will be needed to provide services of sufficient scale and quality for any individual country.

Ownership of the point-of-care location will also change. The classical general health care practitioner (GHCP) who takes care of families, knowing their medical history and social environment over many decades, will partly vanish in HICs. For instance, in Europe, GHCPs generally prefer to work in the city nowadays and no longer in the countryside, although the average patient-to-doctor ratio of 200–400:1 is still high. In LMICs, the density of GHCPs is in general lower, particularly in remote areas. In Africa especially, the density is very low, with a patient-to-doctor ratio of 30,000–50,000:1. The trend is that more and more pharmacy chains, retailers and other business-to-consumer players are taking over point-of-care coverage. Informal health care practitioners will also play a bigger role, however. In the Netherlands, the contribution of informal health care providers is recognized, and they are reimbursed for their contribution to the health care system. If they are given access

to sophisticated services, their potential to make a contribution will greatly increase.

Probably the concepts of personalized nutrition will evolve in emerging countries, although consumers there are currently not demanding personalized nutrition. These services will find their place because they are powerful, practical and accessible, and they can be delivered via family members, volunteers and friends in a much more effective way. Being close to the patient or consumer, these people can provide personalized services to them. Personalized nutrition concepts to prevent chronic diseases may well fit into this group.

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**Correspondence: Arnold Gloor,**

*Director Personalized Nutrition, Medudem AG,  
 Räfifelstrasse 28, 8045 Zurich, Switzerland*

**Email:** [arnold.goor@medudem.com](mailto:arnold.goor@medudem.com)  
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