Social Issues and Public Communication

Introduction

It has been suggested many times that the real issue behind the current controversy and fear by the public regarding RF mobile communication may not be whether there is a real and solid scientific basis for this fear, but rather a lack of **risk communication** and of understanding of public **risk perception** and **risk acceptance**. Also important is the **public's understanding of science**.

Mobile telecommunication is a complex physics and engineering subject, which most of the population does not fully understand. In addition, lay people do not adequately realize that scientific studies on biological effects and health consequences of RF unavoidably have **uncertainty** and may provide conflicting results and trigger discussion among scientists. Unfortunately, while trying to simplify the matter, actions of various interest groups, and in some cases incompetent and irresponsible reporting by the mass media have exacerbated the controversies.

In summary, the nature of scientific endeavor and how knowledge is produced, and how uncertainty is treated and eventually overcome in science, is misunderstood by the general public and it is exceedingly difficult to communicate.

Fear of technology is common and not a novelty: reports from our past tell us of fear of detrimental effects by the public in several instances: trains, telegraph wires, telephones, TV sets, video monitors, power transmission lines, "frankenfoods", aspartame, silicone breast implants, and several others. Curiously, as observed by Dr. Michael Repacholi, former coordinator of the WHO EMF Project for 11 years, the public was not so much afraid of the dangers that we know about, such as glowing radioactive materials used in watches to see the time in the dark, medical x-rays, and spas with radioactive waters and beaches of monazitic sands (both purported to be "curative"), ultraviolet tanning beds, etc. Understanding these different reactions is essential for communication of risks to the public.

Regarding the public understanding of science and the emotional reactions regarding mobile wireless communications, what happens when the object of fear is not perceptible to our senses, as in the case of EMF? Not only can our senses not perceive EMFs, but it takes quite an amount of education to fully understand what they are, how they are generated by different modern technologies or even natural sources, and how they interact with matter and living tissues. Certainly, this is not appreciated by most lay people. It is natural to fear the unknown, and once you have acquired this feeling, it is very hard to remove it simply by rational discussion. An obvious way to cure fear and anxiety about EMF effects is to provide people with as much information as possible (**user education**). However, people providing such information should be very careful to present only well

proven facts, making reference to recognized experts and organizations and, most of all, make every effort not to make the concerns worse. As an example of the latter, stressing scientific uncertainty and implementing precautionary measures may have a negative impact on the public's perception of risk or its trust in policies and government agencies.

The most important factor for the acceptance of new technologies seems to be **risk/benefit comparison**, which is not automatic. Of particular interest to users, industry and government stakeholders in the mobile communication sector, is the fact that apparently few studies have been made on risk/benefit ratios for these technologies, in comparison to many others that have a strong impact on society. Potential harmful effects of mobile phones, such as using them while driving, exploding batteries, deleterious interference with electronic medical equipment (e.g., heart pacemakers), and most of all short- and long-time effects of RF fields on the health of inhabitants and users (such as cancer and electromagnetic sensitivity) have been touted as possible by several researchers and special interest groups, as well as by the mass media. This has prompted an enormous body of research (*e.g,* Valberg *et al*, 2007), mostly in the last 10 years or so, with considerable expenditure of money that could have been better used in more serious and prevalent health issues, such as AIDS, dengue fever and malaria, and has caused a significant amount of concern and even panic among the population. Despite the existence of an overwhelming body of serious research showing that all these phenomena either do not exist or are seemly very rare *vis-à-vis* the enormous number of devices in use (with the possible exception of effects on the performance of drivers, Goodman *et al*, 1997), irresponsible or alarmist media diffusion have created a public view that is quite out-of-step with the scientific evidence.

Any and all technologies have their share of risks. They must be counterbalanced by a careful study of its benefits. Such is the case of automobiles, motorcycles, airplanes, chemicals used in agriculture, food conservation and cleaning, oil and coal combustion, nuclear power, genetically modified foodstuffs, etc.

Society has recognized and accepted all of them, considering their usefulness and adoption rate. For example, lthe lifetime risk of death for constant use of motorcycles for personal transportation is about 1:200, but this hasn'd done anything to reduce the use of motorcycles, on the contrary.

At the same time this has imposed risk management procedures, enforced maximum levels of exposure, encouraged technological improvements, required preventive measures, etc. In order to do the same for mobile technologies, more studies focusing on the social and economical benefits of mobile communication technologies are urgently required.

This section covers the report on social research and communication to the public, and addresses the following interrelated topics:

- Risk perception, risk acceptance and risk/benefit issues
- Social resistance against technology
- Understanding benefits: perceived and real impacts of mobile communication on health, wellbeing and security of the public
- Public understanding of science
- Scope and aims of public communication on EMF and health issues
- Communication of health risks to the general public

- Communicating scientific uncertainty
- Applying and explaining the precautionary principle
- Evaluating the quality of information to the public
- Assessing ethical and professional responsibility of the mass media concerning health and EMF

Risk Perception, Risk Acceptance and Risk/Benefit Issues

The first study we highlight here tried to characterize risk perception in Chile using a psychometric paradigm (Cifuentes & Bronfman, 2003). Its goals were 1) to assess which hazards preoccupy the public, 2) to describe those attributes of risk that influence the populations' perception of them, 3) to explore differences between perceived social risk and perceived personal risk, 4) to explore risk acceptability issues, and 5) to study data variability when using disaggregate data instead of aggregate data. The survey considered a list of 54 hazards grouped in categories: environmental, technological, transportation, forbidden or addictive substances, chemical pesticides and substances, natural disasters and social ills, and others. Cell-phone antennas were included within technological hazards. The fact that it encompasses most hazards people may ever worry about helps put mobile telephony in perspective as an environmental problem

What hazards preoccupy the public? The highest social risk perceptions were of forbidden and addictive substances, natural disasters, social illnesses, and environmental hazards. Cell phones fell into a mid level, next to high voltage lines or genetic engineering; both in the technological group.

Some segments of the population are more risk-adverse, other are less so, so analyses about the hazards that preoccupy the public should take age, gender, schooling, socio-economical level and perhaps profession into account. For example, Martha et al. (2007) investigated how adolescent perceive health risks, driving while using cell phones and social risks (incivility) and concluded that they tend to disregard health risks, only. Older people, on the other hand, tend to perceive health risks much more acutely.

Risk/benefit balance. As we have remarked above, the benefit deriving from an activity, substance or technology plays a fundamental role in society´s attitude toward it. As expected, environmental hazards, such as forbidden or addictive substances, are generally perceived as having a high risk and small benefit, resulting in a negative net balance. Technological hazards, like mobile telephony, were rated as presenting comparable risk and benefit, especially in personal terms, but were scored by users in the study with small deviations towards risk or towards benefits.

Perceived social risk versus perceived personal risk. The difference, defined as **risk denial** (because, although the risk is perceived by society as a whole, it is not perceived at the same level or manner at a personal level), is positive for almost all hazards, i.e. the first is larger than the second. Environmental hazards present a small risk denial, showing almost equal perceived social and personal risk. Forbidden or addictive substances cocaine, marijuana and HIV have the highest risk denial. Smoking has a very large risk denial among smokers, the inverse being true for nonsmokers, a well known fact. These observations reflect the fact that, in these cases, the individual can keep control and believe *"this may not happen to me".* How is mobile communication risk denial

considered? It depends on which part of the technology is being considered: base stations or handsets. For handsets it is high, since they are increasingly being bought and used, despite a high perceived social risk fueled by media information. Regarding base stations, risk denial cannot be assessed with a simple percentage or average, since there are people living near towers, and people living quite away from towers (or who don't see small microcell antennas, or antennas installed on rooftops) and this influences strongly the perception of personal risk.

Acceptability and risk attributes. As expected, the degree of acceptability of a risk correlated negatively with its perceived social risk but positively with its perceived social and personal benefit (Siegrist et al., 2005). In the Personal Benefits vs Dread Risk relationship, cell phones ranked more or less in the middle or, in other words, their potential risks are well compensated for by their evident benefit.

In this respect, Siegrist et al. (2005) in a study carried out in Germany showed that "*trust in authorities was also positively associated with perceived benefits and negatively associated with perceived risks. People who use their mobile phones frequently perceived lower risks and higher benefits than people who use their mobile phones infrequently. People who believed they lived close to a base station did not significantly differ in their level of risks associated with mobile phone base stations from people who did not believe they lived close to a base station*."

Risk and benefit perception. As in other studies, perceived social risk correlated inversely with perceived social benefit and the reverse with acceptability of a risk. This could imply that the perceived risk of a hazard may be decreased by identifying and emphasizing its benefits. However, the observed correlations do not imply a direct relationship between the two variables, since there is no causal link between them. Instead, risk and benefit may be influenced by a third variable, ***"social trust"*** being a likely candidate. Although likely this hypothesis remains to be tested for mobile telephony. The perception of risk is also influenced by the public's trust in authorities (Covello, 1991).

This very general conclusion of the Cifuentes & Bronfman paper may well apply to mobile telephony. Concerns about cell phone masts may continue to occupy press space but in the meantime the number of mobile phones has increased in Chile (and in most of Latin America) to more than one per inhabitant, which speaks clearly in favour of acceptability versus potential health hazards.

Another paper (Barnett *et al*, 2007) reports the results of a nationally representative survey that explored public responses to a leaflet issued by the UK Department of Health (DoH) in 2000, providing information about the possible health risks of mobile phones. Their results are very informative of what can be done to evaluate the impact of a given action on social issues and communication with the public.

Two leaflets were produced by the DoH; one about mobile phones and the other about base stations. The focus of the study on public perception is that the leaflets simultaneously communicated uncertainty and precautionary advice. Assuming that more personal control would improve risk perception, the leaflet outlined that, in the face of uncertainties in knowledge, *"there are ways in which you can choose to minimise your exposure to radio waves"*. Three options of precautionary advice were outlined: keeping calls short, those under 16 years of age minimising non-essential calls, and consumers taking into account the SAR (Specific Absorption Rate) when purchasing a new handset.

The analysis of results of such dissemination efforts must take into account, however, that possible health risks from mobile phones are generally seen as rather less serious than a range of other risks, as described above. Available data also suggest that an appreciation of the benefits of mobile telephony offsets concerns about possible risks.

Often governments start initiatives towards responding to public concern about risks, feeling that "*something must be done*", but then fail to evaluate (qualitatively) or measure (quantitatively) the impact of measures taken. They also fail in providing any information on benefits, probably because they feel that they are self-evident.

As discussed in more detail later, the results of surveys by Weidemann & Schütz, (2005) and Weidemann *et al* (2007) confirm the view that *precautionary advice is generally associated with increased concern rather than providing reassurance*. Interestingly, regardless of the initial level of concern about uncertainty, the general trend is towards increased concern triggered by government advice. This suggests the need for care about the provision of precautionary advice as part of public health information. It seems clear that providing such advice as a response to public concern is unlikely to actually reassure. Even more, research suggests that for those who have strong concerns, information about uncertainty might provide support to their beliefs and result in new facets of the hazard. It is something like "*if they say that there is uncertainty, and that it is better to use precaution, then they are hiding the truth from us and its more serious than they are saying.*"

Social Resistance Against Technology

Since the textile workers led by John Ludd protested against the introduction of semiautomatic weaving machines in the 18th century, the resistance of certain groups in the population to the introduction of new technologies, which are felt to be disruptive to the social order, detrimental to the job market or threatening in some way, has been called *luddism*.

More than ever in the past, however, we are witnessing a popular movement which uses allegations about potential damage to health as the pretext to protest and to resist to a new technology (Burgess, 2003), or rather, to a very specific aspect of a new technology, which is the installation of large masts (called *Greenfields*) and sometimes rooftops, which support base stations in residential neighborhoods. This social movement, which in some Latin American countries, like Brazil, has reached the point of violent intervention by activists (masts were destroyed by angry mobs, and technicians have been physically assaulted and had to be protected by military police) is an interesting (and important) phenomenon and has been studied in detail by some scholars.

For example, Drake (2006) studied the attitudes and beliefs of one of these protest groups and examined "*how and to what extent health issues dominate the group's concerns and how the campaigners have engaged with scientific knowledge to form their opinion."* They discovered that, albeit most of the members of the group used cell phones, they had a militant and biased opinion on the health effects of base stations, and that they believed that the precautionary principles were not being applied by mobile telephony providers. They also felt that science and technology, at least in this case, was not leading to a better quality of life.

It is important to note that these protest groups form a tiny, but very vocal and exceedingly active minority. The “silent” majority, which is either indifferent to the issue, or oppose the minority’s views and positions, does not manifest itself. Politicians are therefore pressured by an unbalanced representation of the people’s views, an unfortunate fact, which is responsible for most of decisions that are not based on science. When the opinions of the whole population can be tested with a plebiscite (such as happened in Liechtenstein, for examploe), the majority wins. In this particular case, the proposal for more restrictive criteria for base station emission standards was defeated.

In principle, social communication strategies for these groups, in order to induce more balanced views, seem to be not very effective. Although some of their members that have less firm convictions may be more receptive to rational, science based arguments, their core is sometimes made of fanatical, inflexible individuals, who consider themselves as crusaders and evangelists. Since any technology can be accused by anyone at any time to be detrimental to humans, the only way to bring such groups to reason is to make them understand better how RF fields are used in telecommunications (public understanding of science) and to raise the balance of risks and benefits, by understanding better the benefits of mobile wireless communications, i.e., its positive social impact. It is what we discuss below.

Understanding the Benefits of Mobile Wireless Communication: the Social Impact

Despite its social importance and phenomenal presence, telephone technology, since its invention and mass adoption in the late 19th century, received surprisingly little social research. According to Geser (2004)

> “*no considerable efforts have been made to gain a synopsis of its multifaceted impacts on various fields of social life, and no integrated theory has evolved concerning the specific functions and consequences of phone communication (…) This deficit only illustrates the larger tendency to ignore the impact of technologies on the unspectacular aspects of everyday life (…) Evidently, the cell phone seems to evoke much less intellectual enthusiasm and scientific research endeavors than the World Wide Web. (…) Such views ignore the basic facts that in comparison with PC’s and Internet technologies, cell phones are used nowadays by broader strata of the population all over the world, and that for many users, they have stronger impacts on social life, so that most of them are ready to spend much larger sums of money on monthly phone bills than on Internet provider services (…) This diffusion has occurred worldwide, rather independently of different cultural habits, values and norms*.”

This impact is apparent in at least two levels of the social activity: personal and work. However, several authors have pointed out that “*the boundary between work and personal life slowly disappears as people can easily use mobile communication technology simultaneously for personal and business purposes in both social and work-related contexts.*” (Peters & ben Allouch, 2005). This has been called the *“always on” paradigm shift,* which previous communication media, such as fixed phones, did not allow. Several sociological studies have shown that private communications have invaded the workplace, and work-related communications have conversely invaded the private sphere of individuals (Geser, 2004).

A study funded by the European Commission regarding the use of information and communication technologies (ICTs) in European countries has suggested that "*mobile communication (…) allows a more flexible form of communication. (…) It allows one to fit socialisation into the nooks and crannies of everyday life and possibly obviates the need for social contact in the context of other, more formal institutions.*" Sociological studies have shown an interesting "backtrend" provided by the highly personal way of wireless portable communication devices: *mobile phones are re-creating the more natural, humane communication patterns of pre-industrial ages* (Fox, 2001, *apud* Urry, 2007). According to Geser (2004), "*the cell phone gives rise to a new trans-spatial version of particularistic communalism: thus making the mobility enforced by modern urban living conditions compatible with the maintenance of rather primordial modes of social integration*". In other words, mobile interpersonal communication networks are *the* real global village, as envisioned by Marshall McLuhan, not television and radio, as he originally stated, which are unidirectional.

What tangible benefits mobile communication could bring to individuals? Current research shows that the public has absolutely no difficulty in recognizing them at a personal level, while the benefits for society as a whole are not brought to mind so easily.

In regard to these overall social benefits, according to a 2001 review by the UK Office for National Statistics, personal communication devices, such as fixed and mobile phones, have had a large impact on outcomes related to economic growth, social inclusion, better health, safety and well-being (Haddon, 2002). This so-called "*social capital*", according to a 2002 report by its Policy and Innovation Unit has shown positive impacts to varying degrees, as supported by empirical research. It may:

- facilitate better economic performance, for example through reducing transaction costs, enabling the mobilization of resources and facilitating the rapid movement of information
- facilitate the more efficient functioning of job markets, for example by reducing search costs.
- facilitate educational attainment;
- contribute to lower levels of crime;
- lead to better health;
- improve the effectiveness of institutions of government.

Since the early history of mobile communications using cell phones, anecdotal evidence of everyday life pointed out that, many times, having a cell phone at hand for urgent calls in road accidents, sudden life-threatening disease onset, or getting lost or having a punctured tire in a dangerous neighborhood, etc., has been a decisive factor for saving lives or improving safety and security (Geser, 2004). According to this author,

> "*The cell phone can be extremely useful for interconnecting emergency agencies with their environment, by increasing the likelihood that somebody watching an emergency event has a phone and is disposed to make a call. In particular, cell phones can shorten considerably the time span for the arrival of institutional helpers like ambulances, fire workers or policemen: so that they have better chances for effective intervention: e.g. keeping the heart attack patient from dying, preventing the fire from spreading or intercepting flying burglars*."

Of particular relevance for the present report, in the seminal study by the American research firm Frost & Sullivan in 2006, on behalf of the GSM Association (GSMA, 2006) on the social impact of mobile telephony in four countries of Latin America (Brazil, Colombia, Argentina and Mexico). Health and security were high on the list of applications with a large social impact in rural and semi-rural areas. About 35% of the users reported using cell phones for emergency calls, and 18% for calls to hospitals and physicians; but most significantly, 40% of users reported making more calls for each one of these compared to before they owned a cell phone. In other words, mobile telephony increased significantly the level of communication related to health and security. Community leaders of these areas, when asked what were the applications with higher social impacts, they chose security in first place, followed closely by health.

Although a direct link between the acquisition of a mobile phone and positive effects on overall quality of life has been hard to demonstrate in developed countries (where the quality of life is already very high), it is possible that mobile telephones are having a more pronounced impact in countries where communications infrastructure has hitherto been less extensive, so that incremental benefits are harder to detect. For example, a Vodafone study in South Africa has demonstrated that 16% of users in that country report using the cell phone for calling police or security. Another example is a study on the use of cell phones by small entrepreneurs in extremely poor countries, such as Rwanda (Donner, 2004), which demonstrated a huge impact of cheap mobile communications on the social and economical viability of small enterprises.

The perception of cell phone users regarding its usefulness for security is also very high. In the Latin American survey cited above (GSMA, 2006), 67% of the users reported feeling safer when emergencies arose (the highest in the list of perceptions), and 38% felt more protected from robbery. The most cited uses for cell phones in this area were:

- To call the police in case of robbery and theft
- To call the police in cases of family violence
- To report robberies in the street or highway
- To call relatives for help in case of suspicious noises
- To call for help in cases of vehicle malfunction or flat tyre
- Health concerns are also a major direct benefit of owning a cell phone. The users researched by the Frost & Sullivan study (GSMA, 2006) reported the following main uses:
- To check on the health status of an ill relative
- To call the pharmacy for delivery of drugs
- To call for ambulances and medical help in cases of sudden illness or medical emergencies
- To consult a physician on modification of a therapy regime, to follow up a case, etc.
- To warn about accidents with victims on the road
- To communicate with hospitalized relatives or friends

In a small scale study carried out by Coates (2001) among university students, 33% of respondents gave calling in emergencies as one of the reasons they acquired cell phones. A high level of correlation was also reported between gender and the motivation to purchase a cell phone. Females purchased phones primarily for emergency usage. In

another study in Africa, 16% of respondents reported having used mobile phones for notifying police or for personal security purposes (Samuel *et al,* 2007).

The final and most important research question regarding social impacts of cell phones when compared with other forms of telephony (private land line or public telephones) is whether there are applications that are *clearly unique* for mobile phones or *are more used* with cell phones than with other means. This question has been not been researched in depth in most studies so far: it could provide a very relevant input to risk/benefit analyses of mobile telephony in many settings. But there is no doubt that they are: as cell phone models advance in their capabilities, such as text messaging, electronic mail and internet access, embedded photographic and videocameras, GPS localization functions, etc, they depart more and more from common telephony and become clearly unique in their several novel applications and usefulness to the users. For instance, there are reports in the news that users who have been kidnapped by robbers and stowed away in their car's trunks, were quickly located and freed by police after receiving a distress call from the victim's cell phones, thus avoiding injury and possibly death, because her cell phone was fitted with GPS. The same happened with a couple lost in a forest trail.

Despite the sheer size and growth rate of this social phenomenon, there have been relatively few studies addressing the empirical evidence of the impact of cell phone usage on the health, safety and well-being of the population, particularly in developing countries (Donner, 2004).

A large social study on the impact and use of cell phones in Latin America has been carried out by Sabbatini (2009*, in press*). Two independent, simultaneous surveys were conducted on the same populations, in the same period of time, in three cities in the state of São Paulo, Brazil: São Paulo City, Campinas and São João da Boa Vista with widely different sizes with a total of more than 3,000 respondents: a residential survey using randomized, prospective, continuous, stratified sampling, with the aim of determining general demographics and data about the ownership profile, intensity and variety of usage of mobile phones for emergency calls; and an exhaustive analysis of all incoming calls originating from cell phones to the emergency call centers of the Military Police of the three cities. Assessing the information provided by the two surveys, as well as correlating them with other statistical information available elsewhere, such as records of police stations, etc., improved the power of analysis and interpretation

Among the many conclusions of this study, we can highlight the following:

- Importance of owning cell phones and importance for their lives, as felt by users, were invariably high for all categories of users (age, gender, civil status, profession, education, socioeconomic level, and city size), with an average of 85% of opinions of the phones as important or very important;

- The feeling of importance increased sharply with increasing time of ownership;

- The feeling of importance also correlated highly with having made or not an emergency call.

The main conclusions regarding the use of cell phones to make calls related to safety and health were the following:

- Using a cell phone to make emergency calls, and the number of times it was used

was about the same for people of different genders, civil status and city size, and on average was close to 40% among users;

- There was no difference regarding the use of a cell phone to make an emergency call, whether the user had access to a phone land line or not;

- This kind of usage was higher in younger people from 18 to 30 years of age, but increased also in relation to time of ownership, level of education and socioeconomic level;

- Socioeconomic level was a more influential factor than level of education;

- Users of prepaid phone used proportionally more cell phones to make emergency calls than users of postpaid phones.

Thus, some important facts arose from the study:

- It has clearly demonstrated that cell phones represent today a very important communication resource for preventing and maintaining health and safety of individuals, since almost 40% of its owners have already made use of them at least once for purposes that affect these areas. Cell phones are ubiquitous and an enormously widespread technology in the cities studied (more than 60% of individuals), so their role assumes greater importance. Their inherent mobility and individual use create new opportunities in the fields of security and health of its owner, relatives, friends, colleagues, etc., independently of time and location.

- The pattern of use for making emergency calls observed in the study was closely related to the ownership of a cell phone in several categories, i.e. it increased with higher socioeconomic class, higher education level, and younger age. However, it does not correlate, as ownership does, with gender, city size and married status.

We could interpret these results in the light of **perceived value of a technology**. It would be expected that users who acquire mobile phones attribute a high value to them; otherwise they would not buy them. This has been shown in an analysis of the importance of cell phones as indicated by users: they were invariably high for all categories of users (age, gender, civil status, profession, education, socioeconomic level, and city size), with an average of 85% of opinions rated as important and very important. The value of a technology increases automatically when one uses it at least once for some purpose. This is clearly apparent as demonstrated in this study, where users with a longer time of use (more than 2 years) value more (give more importance to owning a cell phone) and make more emergency phone calls. Then the difference appears, and people with a higher interest in having cell phones consequently use them more for making emergency calls.

It is noticeable also that although users tend to feel that cell phones are important, (85% of the users in the survey consider them important or very important for their lives), a smaller percentage have made use of them for really important, emergency or life-saving situations. This has been observed in other studies in Latin America (GSMA, 2006) and elsewhere. In the Frost & Sullivan survey, 86% of the users considered that mobile communication was important for their safety and health, and 67% felt more secure by having access to one, but only 35 % actually used it for safety and health purposes. This might be explained by social awareness phenomena (e.g., knowing about other people

who made use for these purposes, rather than having a direct experience themselves).

Restating our initial question: what makes mobile telephony different from fixed line communication?

Mobile communication stands on its own name**: spatial mobility**, or freedom to be in any location to be able to communicate. In this way, "*wireless transmission technologies are certainly at the root of all innovations that make communication compatible with spatial mobility. Seen in this very broad evolutionary perspective, the significance of the mobile phone lies in empowering people to engage in communication, which is at the same time free from the constraints of physical proximity and spatial immobility. As it responds to such deeply ingrained and universal social needs, it is no surprise to see the mobile phone expanding worldwide at breath-taking speed. In fact, there are reasons to assume that it would have been equally welcome in all human societies and cultures in the past: that is, under all imaginable specific cultural or socio-economic conditions*." (Geser, 2004). The sense of freedom is one of the most important factors here. According to Spector (1993) "*In fact these technologies should be liberating, freeing users to communicate with anyone, from anywhere, at any time.*"

Many studies were able to prove that this freedom of communication provided by mobile cell telephony has a significant impact for individuals, particularly regarding its impact on health, safety and wellbeing, reproducing what other researchers found in studies in developed and developing countries.

According to Lacohé et al (2003), the ownership of a cell phone is nowadays seen as an essential tool for survival in a "risk society". This term implies that in the last decades, violence, accidents, and general opportunity for mayhem has increased as a whole in most urban environments in the world (more in some, less in others). Families are increasingly acquiring mobile phones for women and children, in order to improve their safety and accountability. Location based services (LBS) based on wireless triangulation and GPS to pinpoint the location of a cell phone are now possible, and becoming popular as value-added services both for operators and users. As early as in 1997, in a survey of business and residential users of cell phones in the USA, Katz found the importance for the "*residential user (of) the readily recognizable effects of increases in convenience, personal efficiency and security, as well as more subtle effects, particularly in the psychological and interpersonal realm (…), such as the need to be in touch or being highly mobile*;"

It should be noted, however, that in large metropolitan areas, with million of inhabitants, cell phones may affect emergency institutions negatively insofar as they cause information overflows:

"*With a mobile phone, a driver can immediately call for emergency help or the 911 service (a safety function), this initially expedites the emergency service. Now emergency services are being inundated with multiple calls for the same emergency, slowing down response time and preventing other emergency calls from coming in*." (Bautsch et. al. 2001).

Sabbatini (2009), while interviewing the commanding officer of the Military Police Emergency Call Center (COPOM), found that one of the problems they had was how to pinpoint whether the calls referred to the same accident; for example, in order to be able to limit the response. Sometimes this is a difficult task due to incomplete information provided by callers, such as the exact spatial and temporal information. The US federal government is now contemplating mandatory GPS functionality in all cell phones, so that

users with injuries and unable to discuss the emergency, have automatic location information.

Another disruptive consequence of widespread use of cell phones on emergency systems is that, in many countries (such as in the USA), the emergency number can be dialed free of charge from any cell phone, even from those that were connected to a line which has been blocked or deactivated, from discarded, lost, stolen or abandoned handsets, etc. This has led to a large increase of prank and unnecessary calls, flooding the calls centers, which are impossible to track (Michels, 2007).

The Issue of Public Understanding of Science

The understanding of science and technology behind wireless communication by the general public is nowadays considered an essential ingredient for good communication of a new technology.

The terms "*public understanding of science*" or "*public awareness of science*" relate to the attitudes, behaviors, opinions and activities that comprise the relations between the general public or lay society as a whole to scientific knowledge and its management. This involves many activities and initiatives, and is a comparatively new approach to the task of promoting science, technology and innovation among the public and provides an integrated and results-oriented view, within a single framework a series of other fields, such as: science communication in the mass media, Internet, radio and television programs; science fairs, festivals and exhibits, education (children, adults and specific groups, such as consumers, physicians, industrial hygiene and safety, government officials, politicians.

Not only the very basic information about how wireless communications work, but the nature of the physical agents involved, and its interaction with living beings, must be properly understood and accepted by the population, before evaluation and acceptance of risk occurs among members of the public. In addition, in fields where near certainty has not been achieved in science, special care must be taken by social communicators how to disclose and how to consider scientific uncertainty. Most of the general public has not been trained or is unaware about how science works, how it arrives at a consensus, how knowledge and theories are provisory and continuously and inevitably change.

Disclosure of Scientific Uncertainty

While lecturing on health effects of EMF to the public, Vanella *et al,* (2006) found that when mention of the International EMF Project, sponsored by WHO, was made to a lay audience, most reactions were negative. A typical "feeling" was that, *"if there are on-going studies it means that there are no conclusive results yet. And this is not good. It's better to stop everything (typically authorization of new communications installation or new regulations on he subject) until WHO presents good results!!"* Put in lay words, *"there is no smoke without fire".*

Unfortunately, science is not so perfect as the public tends to believe: there is an abundance of epidemiological studies, which are most often the most impacting source of information for the general public, since they often deal with cancer and other feared

diseases, and use very large numbers of diseased individuals; that have sown confusion and uncertainty more often than not. Many studies directly contradict others, in terms of affirming whether there exists an association between EMF exposure and detrimental health effects, despite an enormous number of uncertainties, biases, and a lack of solid and incontrovertible scientific evidence. Results based on faulty designs, statistical artifacts and unjustified interpretations abound. According to Tauber (2001), "*many epidemiologists concede that their studies are so plagued with biases, uncertainties and methodological weaknesses that they may be inherently incapable of accurately discerning weak associations.*" In this way, many critics of the long expected INTERPHONE Project results published in May 2010 have pointed out that they are so riddled with doubts and exceptions that the reporting by the lay press did more harm than good for the cause of science.

This has been called the "*scandal of poor epidemiological research*" (van Elm & Egger, 2004), and physicians and researchers have called for more prudence when divulging results to the media (Hazinski *et al.*, 1995):

> "*...concerning the public's confusion about the results of clinical trials, I think the public and the media would be better able to assess research results if medical researchers themselves were more modest and careful when discussing their results with journalists. The NEJM has led the way in embargoing research results until after publication, but such rules cannot prevent the ambitious or naive investigator (or the investigator's institution) from touting results and pushing conclusions beyond the limits of the data.*"

The public at large is not prepared to accept scientific uncertainty and to understand epidemiological results in terms of probabilities, and will not be satisfied with a conclusion that is really the absence of conclusions. This justifies the need to provide information to society about the methodology of scientific work and the uncertainty that, within certain limits, it implies. At the same time, governmental agencies should adopt effective measures to verify compliance with regulations under strict control by independent parties (Vanella et al, 2006). It is well known that, even when the technique, equipment and expertise to perform measurements of EMF is available to almost everyone, results will be acceptable to the public only when they are not performed by parties who have a vested interest. In simple words, people will readily accept results provided by a university but will not trust results provided by a telecommunications company, even if they concern his own installations (Bruni et al, 2003).

The Precautionary Principle and Cautionary Policies

What do we understand by precautionary principle?

As Wood (2006) noted, *"In the event of scientific uncertainty as to either the nature or origin of a risk to human health, responsible agencies may wish (…) to take protective measures without having to wait until the reality or seriousness of those risks becomes apparent*".

There is an on-going debate about whether EMF exposure from communications, or other sources, has sufficiently consistent scientific evidence of hazard to actually trigger this "precautionary principle" (Foster *et al*., 2004), and that its unjustified exageration for

everything might be a kind of environmental extremism (Foster, 2003). Some authors (e.g., Eisinger, 2004, comments on Foster et al, 2004) go to the length of stating that the precautionary principle might be self-defeating, since it has transfer of risks instead of risk prevention as the most probable outcome, and that therefore it might be dangerous in some situations.

Current advice by WHO is that *"Considering the very low exposure levels and research results collected to date, there is no convincing scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects"* (WHO, 2006)

Nevertheless, everybody seems to be happier taking some precautions. As an example, in Australia and New Zealand, safety standards have a mandatory requirement to *"minimizing, as appropriate, RF exposure which is unnecessary or incidental to achievement of service objectives or process requirements, provided that this can be readily achieved at modest expense"*

Enhanced precautionary measures for special groups, such as children, seniors, or for places which are deemed abnormally sensitive, such as hospitals and schools, have often been called for, and, in fact, have produced many laws suposedly trying to protect them, such as observing a minimal distance from base stations. This is a form of irrational behavior, based on cultural, emotional and political arguments, not scientific ones (Vecchia, 2005), since the ICNIRP, and other standards of protection in place were devised in order to protect everyone within a science-based framework, including special groups and places. The fact is that these standards have been periodically reviewed in the last 25 years, and no reason has been found so far to change them in light of scientific evidence.

Phone manufacturers have responded to community concerns by making SAR values of their handsets available, to allow this to be a factor in consumer choice. Similarly, policies of co-locating antennas owned by several operators on a single mast and wherever possibly locating these masts away from schools, represents a prudent approach by industry.

On the government side, one possible response to public concerns is to conduct EMF surveys and to provide as much information to the community as possible, as done e.g. by the Health Protection Agency of UK (http://www.nrpb.org/hpa/radio_surveys/) or the corresponding Australian agency, ARPANSA (http://www.arpansa.gov.au/). An example in Brazil, is the city of Americana, São Paulo State, where a survey has been done by CPqD (Centro de Pesquisa e Desenvolvimento: http://www.cpqd.com.br/monitor/americana/). The results of this survey has been made publicly available on the Internet for consultation by all citizens who simply must provide their home address in order to get measurements of power density from the nearest base station.

Regulations normally require measurements or theoretical estimations of EMF levels around antennas and other sources. Publishing those results may satisfy people living near these installations, but what about the majority of the population? This is the reason why many large-scale EMF surveys have been performed. From the results of similar surveys every citizen should ideally be able to pinpoint EMF values near their residence. In practice, large area surveys have proved costly if performed on every city block corner or road crossing, and even more so if a permanent monitor is to be left acquiring information

at every site. An alternative has recently been reported by a university laboratory in Argentina (Taborda et al. 2006) which developed a method to survey EMF from a moving vehicle, adding GPS data in order to permit mapping of radiation levels. EMF data can be coupled to city maps, satellite images and adding specific data on existing communications installations. An added bonus is that this method allows detection of uncharted or undeclared installations by simply setting the EMF measuring range as a scale of colors to be assigned to each measurement point.

ARPANSA went even farther and, starting July 2003, commenced Australia's first centralised Electromagnetic Radiation (EMR) Health Complaints Register, thus opening the door to two-way communications between the community and the government agency. The Health Complaints Register collects reports of health concerns related to EMR field exposures in the range of 0-300 GHz. The register is not limited to telecommunications equipment and broadcasting transmitters but includes reports related to sources such as power lines, induction heaters, microwave ovens and other personal, industrial and scientific equipment producing electromagnetic fields.

The emphasis in the UK has been to make available to the public detailed data on the type and location of masts (see: http://www.sitefinder.ofcom.org.uk/) in order to promote effective dialog between planners, operators and the community in decisions regarding installations location. In Italy, the Ugo Bodoni Foundation has established a nationwide EMF monitoring network (http://www.monitoraggio.fub.it/).

As mentioned often, the justification for invoking the precautionary principle is scientific uncertainty. The reason can be – and often is - political. Risk perceptions can become triggers for precautionary action. Experiments reported by Weidemann and Schültz (2005) intended to test two opposite hypotheses about the impact of precautionary measures on risk-related attitudes and beliefs. First, precautionary measures will increase trust in risk management, which, in the end will be associated with lower risk perceptions. Second, the alternative hypothesis points to the possibility that precautionary measures will be considered a clue that the risk might be real. Hence, perceived risk could be amplified.

The conclusions of their experiment were that precautionary measures implemented with the intention of reassuring the public about EMF risk potentials seem to produce the opposite effect. They may amplify EMF-related risk perceptions and trigger concerns.

Public calls for precautionary measures have been increasing in all countries, particularly after the massive roll out of 3G technologies, despite a lack of evidence for it. Many have argued that international safety standards are inherently cautionary.

> *"The precautionary principle is difficult to define, and there is no widespread agreement as to how it should be implemented. However, there is a strong argument that precautionary measures should not be implemented in the absence of reliable scientific data and logical reasoning pointing to a possible health hazard. There is also experimental evidence that precautionary advice may increase public concern. We argue that conservative exposure standards, technical features that minimize unnecessary exposures, ongoing research, regular review of standards, and availability of consumer information make mobile communications inherently precautionary. Commonsense measures can be adopted by individuals, governments, and industry to address public concern while ensuring that mobile networks are developed for the benefit of society." (Dolan & Rowley, 2009)*

Communication with the Public

Assuming that the public at large is not sufficiently informed about EMF, the obvious path of action to take is to provide people with as much information as possible (Vecchia. 2004). Naturally, information coming from an interested party, such as the communications industry, will be mistrusted. In contrast, government agencies, research institutes or universities may be accepted, provided they have no financial ties with involved companies.

Out of the many existing methods, we have chosen three to evaluate, with different degrees of efficacy. Firstly, the most popular and modern system is to use the Internet. It is low-cost and readily accessible, although web accessibility is not evenly spread among Latin American countries and is certainly more limited than in Europe or the USA. On the other hand it is relatively passive: the information will always be there, but not necessarily it is reached by the proper people. The Internet has also the disadvantage of being available and used by a small part of the population, which is exactly the most well-informed one. In Brazil, for example, only about 20% of the population has regular acccess to the Internet. This proportion may vary around this value in other Latin American countries.

A second method is the organization of events to reach the lay people, particularly at those places where situations of conflict have arisen. Experience in Argentina (Vanella et al., 2006) can be described as:

Conflicting situation → Urgency to implement a measurement campaign to assure the public that every EMF source (antennas) is within regulatory limits → Public presentation of results → Questioning of the measuring experts by the public and debate → Development of a standard,.

More than 40 presentations lasting 1-2 hours, followed by debate and distribution of a FAQ (Frequently Asked Questions) were organized during a two-year period in a wide range of locations, from province capitals to small towns with less than 1.000 inhabitants, so enough experience was accumulated to offer some conclusions. The method proved very effective at “defusing” conflict situations for several reasons: first, the project was conducted by a university research lab, therefore providing scientific and independence credibility; second, regardless of how informed was the public at the time of a presentation, nothing can compete for people´s satisfaction better than first hand contact with experts; and finally, the presentations showed results of measurements made in the locations of the meetings a few days before. In fact, it is not helpful to show lay people results of measurements made far away from them, or even in foreign countries; it is more useful to show measurements made close to them.

Even when personal presentations by experts might be very effective, to have greater impact a large number of experts would be needed to perform extensive measurements in the area! While we may find many experts on communications and EMF with doctorate degrees, it is not that easy to find among them the ability to communicate with lay people in simple terms. The obvious conclusion is that this method is valid only for a few conflict locations within a region.

A third method could be named “back to basics” in communication technologies. Besides the internet, the media offer a wide selection broadcasting tools. Television is still one of the most popular vehicle of information, although EMF & Health is not a popular topic for TV. Radio is still very much popular in wide segments of Latin-American population, especially that in the D and E socioeconomic classes, therefore it might be a very effective and influential communication medium for this. Unfortunately it is little exploited in this context.

Almost every review of the scientific literature includes a section on social research and communication to the public. A representative summary is provided bythe following *Recommendations for risk communication* from the work by the Ministerio de Salud Pública y Consumo de España (2002):

- *Utilize a comprehensible and objective language in order to enable citizens to take well informed decision*
- *Warn that, even when exposure to EMF may come from many diverse sources, the risk probability of exposed people is very low, provided the radiation levels comply with existing regulations*
- *Society must be informed in order to decide what risk level is ready to accept. This level must be the lowest possible that can still ensure proper use and safety of new technologies (please refer to above reference to earthquake in Peru, 2007)*
- *Inform over the high degree of safety guaranteed by present regulations or recommendations, whether national or international, without underestimating potential risks, regardless of how remote they might be*
- *Pursue and maintain a proactive policy, not reactive, towards documentation and scientific information, with a permanent update of results generated by present research under way and future developments*

Choosing the right language carefully is an important element in communicating with the public, and it is recommended that specific approaches be used with certain segments of the public, such as lay people, journalists, teachers, etc (see the WHO monograph on communication about EMF). For example, MacGregor et al (1998) tested the beliefs of a lay public about ELF-EMF risks for health before and after reading a brochure, and found that “*the naive beliefs about the potential of EMF exposure to cause harm were highly influenced by specific content elements of the brochure.”.*

Special Segments of the Public

Besides the general, non-specialized, non-technical lay public, other more specialized sectors of the public need to be better informed about the science of EMF and health. These are physicians in general (occupational physicians in particular, since they are involved with environmental health and health risks posed by environmental agents), industrial hygiene and safety technicians and engineers, etc.

For these professions, the best approach seems to be courses. Sabbatini (2009b, submitted), has developed the first course of this kind in Latin America, specifically geared

towards occupational physicians, and an on-line video lecture with the basics of EMF and health, and which are freely available over the Internet. These products were developed in reaction to a survey with more than 400 occupational physicians and industrial safety and hygiene technicians, which indicated that more than 80% of the participants wished to attend such a course (Sabbatini, 2008, submitted).

The Role of Governments and International Agencies

Several international agencies deal with the subject of NIR, notably WHO, IRPA and ICNIRP. WHO is the only institution of the United Nations with a clear mandate to promote research over possible health effects of exposure to NIR and, through the International EMF Project, it compiles information and coordinates available resources from other international and national agencies and research institutions. Such an accumulation of scientific facts must be transmitted to the public at large in order to avert public apprehension to the widespread diffusion of new technologies. Now the fact is that very few people visit the EMF Project web page http://www.who.int/peh-emf/en/.

It should be normal that local agencies contribute to disseminating WHO-EMF Project results and fact data until information reaches the public. Nevertheless very few Latin American countries participate in the EMF project.

What is the situation in Latin America regarding the role of government?

The OAS, the Organization of American States, the local equivalent of the UN, has recognized the importance of Telecommunications and long ago established the CITEL, http://www.citel.oas.org/. CITEL is the main forum in the hemisphere for governments and the private sector to meet and coordinate regional efforts to develop the Global Information Society according to the mandates of the General Assembly of the Organization and the mandates entrusted to it by Heads of State and Government at the Summits of the Americas. CITEL meets periodically, and the proceedings of every meeting are the best compilation of up-to-date regulations and activities on Telecommunications in the Americas.

In the prologue to the most recent version (CITEL, 2003), Héctor Mario Carril, Vice President of the Permanent Consultative Committee II: Radiocommunications including Broadcasting, writes:

“Growing deregulation of telecommunication services in the Americas has increased the number of operator companies and the development of radio systems with its consequent increase of EMF sources. Due to the generalized use of these technologies , public worry has also risen and accurate scientific studies are necessary to resolve any doubt and allow sustainable decision making in order to preserve public health while maintaining an effective communication among citizens, providers and authorities.

Said communication about the possible environmental risks posed by technology play an important role and should be an interactive process of exchange of information and opinions among all persons involved, scientists, government, industry, citizens.

Scientific information may help people to understand both the benefits and eventual complications of EMFs and may help regulators to evaluate different options regarding

risk management and to establish safety measures allowing assessment of the consequences derived from different decisions"

Even when the message clearly states the importance of providing sound, science-based, information about EMF and health to the public, this is not provided with the compilation of Latin American regulations contained in the paper above. Also there is some reluctance (or perhaps simply negligence) to provide this information and communicating it to the population. This has been observed on the very few web pages of pertinent Latin American government agencies identified so far. Therefore, this message becomes a recommendation of what should be done rather than a statement of what is actually happening.

Ethical and Professional Responsibility of the Mass Media

Mass media, such as radio, TV and the Internet are nowadays the most powerful way of capturing the mind and influencing large numbers of people. When well conducted, mass communication campaigns that utilize a combination of several media outlets simultaneously can be extremely effective. For example, in 2004, when a long drought and a lack of capital investments in power plants put Brazil in the delicate situation of having to curtail consumption of electric energy, the federal government launched a highly successful media campaign, complementing a number of other legal measures such as increasing billing for excess energy consumption and the encouragement of the wholesale substitution of incandescent lamps by long-life fluorescent ones. The result was a sudden drop of more than 30% of usage of energy which remained until the reservoirs of hydroelectric dams were full again, several months later.

Science reporting in the traditional Latin American media is very restricted and, with few exception, lacking in excellence standards. Most of the news about EMF repercussions on human health consists simply in uncritical translation or reproductions of press releases and news pieces from foreign media and news agencies. Original reporting in newspapers and TV and radio news programs is very rare, in the sense that the reporters go back to the original sources of information (scientific journals) and the number of scientific journalist who have the ability to scan the original literature and filter out papers with low methodological quality are exceedingly small.

The all important role of mass media can be clarified by fundamental behavioral and psychological issues relating to the fear of the public about health effects of mobile communication.

The public is not intrinsically afraid of using cell phone handsets, cordless phones, and other kinds of wireless radio communication devices, and it seems that no amount of alarmist theories, or even anecdotal reports of detrimental effects on health of users will substantially decrease their wide dissemination in modern society, as long as real and perceived benefits are large, irreversible and valued by society as a whole. This has already been seen in other areas, such as the adoption of risky products and behaviors. In addition, no amount of information or campaigning will change this (unless the health effects were proved to be quite catastrophic, such as in smoking tobacco), and will make people feel that mobile phones are not necessary;

The public is somewhat afraid, or suspicious, of potential health effects of visible and large outdoor *towers* and *antennas* (seemly ugly base stations of the Greenfield type, which

have grown to large numbers in the urban landscape). We emphasize visible and large here, on purpose. This is a kind of fear of the unknown, so that educational and informational campaigns *could* have an effect here. On the other hand, this fear will eventually disappear, due to two factors: the public will get used to the antennas, due to their ubiquity (as it happened with electric transmission wires in posts and large transformers, which became practically “invisible” to many people), and the antennas will decrease in size and become unobtrusive (as already happens with WiFi access points and microcell base stations);

This fear has been fueled by media reports and activists, based more on ideology than on scientific facts.

Key points in the responsibility of mass media are: the uncritical acceptance and publication of all news from the international press and dissemination of results of papers with poor methodological quality or findings not confirmed by independent replication studies : amplification of position statements of ideologically-driven interest groups; and the lack of journalistic ethics when information in polemical areas is published without consulting opponents with differing views.

Therefore strong action towards educating journalists as well as ongoing debate with activists (legislators and the judiciary system) would achieve the highest impact. We feel that universities should strive to produce good science and technology reporters, with a multidisciplinary background, but mostly able to judge the quality of original papers and to criticize the published results.

Conclusions of Social Issues

Latin American references on Public Communication and Social Research regarding EMF are scarce. Most of this review was based on references from country reports in Europe, the USA or other non American countries. The only on-going research project we know about is, “An assessment of the social impact of mobile telephony in Brazil. I. Well being, Health and Security”, being conducted by Edumed, Brazil and so far no results have been published.

- There is a clear need to carry out more research concerning social aspects of EMF in Latin America, along the lines of studies conducted in Europe, Chile and Brazil. What is more important, is to gauge the impact of measures taken, whether regulatory, precautionary or simply communicational.

- The public needs more information. It is astonishing, to say the least, that given the degree of conflict on the subject of EMF and health, there exists so few attempts to inform the public via the mass media or the Internet in Latin America. Obviously more effort is needed in <u>every</u> Latin American country.

- A sustained effort would be made easier if we build and sustain a reference location for Latin America. A repository of information could be maintained and research efforts coordinated for the region, establishing and maintaining at the same time fluid communications among anyone interested on the subject: researchers and professionals in engineering, biology and medicine, government agencies and telecommunications companies, etc...

- If we combine our previous comments into recommendations it would be to set up a national (or even better, a regional) web page specifically dedicated to EMF & Health. Returning to our Aims and Objectives section: **independent consensus** and **scientific quality,** it follows that the page should be based either in the appropriate government regulatory agency or in a prestigious university or research institute.

- Finally it has been well documented that attempts by overzealous governments *"to do something about people´s concerns with EMF & health"* should be carefully evaluated before proceeding, since excessive recommendations on precautionary actions or, even worse, implementing local rules for antenna deployment or lowering threshold limits for EMF with the idea of being more strict and safety conscious than others, tends to increase concern, confusion and mistrust in government instead of reassuring people.

- Having many different rules by municipalities only creates confusion and mistrust of government. On the other hand, adopting science based regulations recommended by international bodies such as ICNIRP countrywide should contribute to peoples' reassurance. In turn, international bodies such as ICNIRP and CITEL are working hard to harmonize standards among countries.

- A larger participation of governmental agencies in international activities, including the International EMF project of WHO would sound to the public as a message of attention to the issue and would help increase trust in the authorities regarding this area of knowledge.

- We recommend also that focused seminars and conferences, as well as several courses be developed and offered in Portuguese and Spanish to special interest groups, such as occupational physicians, journalists, bioengineers, industrial safety and hygiene, etc.