การประเมินบทบาทของผู้ปฏิบัติงานด้านสุขภาพในการส่งเสริมวิถีชีวิตที่เอื้อต่อสุขภาพและสิ่งแวดล้อม: การทบทวนวรรณกรรม

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บทคัดย่อ

การส่งเสริมสุขภาพของประชากร และความสมบูรณ์ของระบบนิเวศน์มีความสำคัญยิ่งสำหรับ ผู้กำหนดนโยบายของนานาประเทศ ได้มีงานวิจัยเพิ่มขึ้นจำนวนมาก ที่ได้ศึกษาถึงความเป็นไปได้ของการรักษาสิ่งแวดล้อมและการส่งเสริมสุขภาพของประชาชนจะก่อให้เกิดประโยชน์ร่วมกันทั้งสองด้าน โดยนักวิจัยส่วนใหญ่เริ่มต้นด้วยการศึกษาบทบาทของผู้ปฏิบัติงานด้านสุขภาพในการส่งเสริมวิถีชีวิตที่เอื้อต่อสุขภาพและสิ่งแวดล้อม บทความนี้จึงเป็นการทบทวน และวิพากษ์งานวิจัยที่ศึกษาว่า ผู้ปฏิบัติงานด้านสุขภาพได้มีการรณรงค์ส่งเสริมให้เกิดประโยชน์ร่วมกัน ทั้งสุขภาพและสิ่งแวดล้อมหรือไม่ และอย่างไร รวมทั้งศึกษาเกี่ยวกับการใช้ความรู้ ประสบการณ์ การรับรู้และทัศนคติ โดยพบว่างานวิจัยส่วนใหญ่มีข้อจำกัดเชิงภูมิศาสตร์ เนื่องจากการศึกษาส่วนใหญ่ทำในประเทศสหรัฐอเมริกา ดังนั้น จึงควรมีการศึกษาวิจัยในประเทศที่มีรายได้ต่ำและปานกลาง นอกจากนี้แล้วข้อค้นพบจากงานวิจัยเหล่านี้แสดงให้เห็นว่า ผู้มีส่วนได้เสียที่ไม่ได้ทำงานด้านสุขภาพไม่มีส่วนร่วมในการวิจัย ดังนั้น ในอนาคตการศึกษาด้านนี้ควรให้มีผู้เชี่ยวชาญและผู้ตัดสินใจที่เกี่ยวข้องกับสิ่งแวดล้อมมีส่วนร่วมในการวิจัยด้วย และงานวิจัยส่วนใหญ่ใช้วิธีวิจัยหลากหลาย แต่ไม่มีงานวิจัยชิ้นใดที่ค้นหาความสัมพันธ์เชิงเหตุและผล ระหว่างคุณลักษณะเชิงจิตสังคม และเชิงสถาบันของผู้ปฏิบัติงานด้านสุขภาพ กับระดับของการมีส่วนร่วม โดยสรุปแล้วผลจากการทบทวนงานวิจัยข้างต้นจะทำให้เกิดการศึกษาวิจัยในมุมมองอื่นๆ ที่จะสร้างความเข้าใจในบทบาทของผู้ปฏิบัติงานด้านสุขภาพในการส่งเสริมวิถีชีวิตที่เอื้อต่อสุขภาพและสิ่งแวดล้อมในขณะเดียวกัน

คำสำคัญ: ความสมบูรณ์ของระบบนิเวศ สุขภาพของประชากร ผู้ปฏิบัติงานด้านสุขภาพ การทบทวนวรรณกรรม

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Assessing the Role of Health Practitioners in Promoting Healthy and Ecologically Sensitive Lifestyles: A Literature Review

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Abstract

Promoting ecosystem health and human health ranks high on the agenda of decision makers worldwide. An increasing number of studies have been investigating opportunities for the fields of population health promotion and environmental protection to effectively promote their many co–benefits. A particularly interesting aspect that researchers have started to explore is the role of health practitioners in promoting healthy and ecologically sensitive lifestyles. This paper offers a critical review of studies which explore whether and how health practitioners promote environment–health co–benefits, and their respective knowledge, experience, perception and attitude. It is shown that the geographical focus of the reviewed studies is narrow with most studies focusing on the United States, suggesting a need for further research especially in low–and middle–income countries. Furthermore, results indicate a widespread neglect of stakeholders from outside the health sector, which points to the need to include, for example, experts and decision makers from the field of environmental conservation in future studies. The methodological approaches of the reviewed studies were found to be relatively diverse. However, there is dearth of studies exploring possible causal relationships between psychosocial and institutional characteristics of health practitioners and their level of engagement. Overall, the outcome of this literature review suggests a number of potential, future avenues of research which may contribute to a better understanding of the role of health practitioners in promoting healthy and ecologically sensitive lifestyles.

Keywords: ecosystem health, population health, health practitioners, literature review

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Introduction

The promotion of both ecosystem health and human health ranks high on the agenda of decision makers worldwide as evidenced by the recent adoption of the Sustainable Development Goals (United Nations General Assembly, 2015). Environmental concern has increased in recent decades as the earth ecosystem has come under increasing pressure from anthropological activities (Millennium Ecosystem Assessment, 2005). At the same time, population health is at the center of public concern. Despite dramatic improvements in medical knowledge and technology, major diseases remain difficult to eradicate or are even on the rise (World Health Organization (WHO), 2016, March 16).

While the issues of ecosystem health and human health have been conventionally treated in conceptual silos (Romanelli et al., 2014), they are actually closely inter–related. Population health in many aspects depends on ecosystem health (WHO, 1986, 2005, 2012). The ecosystem services approach emphasizes four types of services provided by healthy ecosystems which contribute to human health and well–being. Provisioning ecosystem services refer to the provision of raw materials, including clean food and water, which people need to meet their basic needs. Regulating ecosystem services refer to the regulation of ecosystem processes which contribute to human well–being, many of which affect population health, such as the purification of water and air, carbon sequestration and climate control. Cultural ecosystem services are also important determinants of population health as they contribute to recreation as well as to cultural and spiritual experiences and enrichment. Supporting ecosystem services are needed for the maintenance of all other types of ecosystem services (Millennium Ecosystem Assessment, 2005).

Given the heavy dependence of human health on a well–functioning ecosystem, it is clear that the field of population health promotion can gain substantially from an effective promotion of ecosystem health. The same holds true for the field of environmental conservation. It is a potential win–win–situation: population health can be improved by healthier ecosystems while environmental conservation can benefit from the promotion of healthier lifestyles which are in most cases ecologically sensitive lifestyles. These potential mutual benefits are increasingly being recognized by scholars and practitioners working in both fields. There is an increasing number of studies which have assessed the linkages between ecosystem and human health (e.g. Atreya et al., 2012; Friel et al., 2009; Markandya et al., 2009; Sandifer et al., 2015; Shaw et al., 2014; Wall et al., 2015; Wilkinson et al., 2009; Woodcock et al., 2009), and an emerging field of research which investigates opportunities for the fields of population health promotion and environmental protection to effectively promote their many co–benefits (e.g. Campbell et al., 2012; Romanelli et al., 2014).

One particular aspect that researchers have started to investigate is the role of health practitioners, such as medical doctors, nurses and other medical staff, in promoting[1] healthy and at the same time ecologically sensitive lifestyles (Hansen–Ketchum & Halpenny, 2011; Patrick et al., 2011). More precisely, researchers have started to study whether and how health practitioners promote environment–health co–benefits, what prior respective knowledge and experience health practitioners have, and what their perception of and attitude towards this topic is. However, an ad hoc literature review suggests that the number of scientific studies on the potential and current role of health practitioners in the promotion of such lifestyles appears to be small in numbers and limited in scope, suggesting a need for further research in that area.

In this paper, a critical review of studies which investigate the consideration of co–benefits between human and environmental health by health practitioners in their work is offered in order to obtain a state–of–the–art overview of research efforts and gaps in this field. It is expected to be useful for deciding whether and, if yes, what type of further research is warranted. The remainder of this article is organized as follows: In the following section, examples of "healthy and ecologically sensitive lifestyles" are given. Section 3 describes the methodological approach that was used to review the current body of literature. In Section 4, the results of the literature review are presented and the last section discusses these results and draws conclusions.

Examples of healthy and ecologically sensitive lifestyles

In this review, "healthy and ecologically sensitive lifestyles" are referred to as lifestyles which have predominantly positive effects on both human health and the functioning of ecosystems. In the following, several examples of such lifestyles are given.

One way of living which simultaneously benefits both population and ecosystem health is the use of active travel and public modes of transport instead of private car travel. According to Woodcock et al. (2009), a reduction in private car travel and increased active travel (i.e. distances walked and cycled), has positive effects on human health in terms of (i) reducing the health burden from urban outdoor air pollution, and (ii) reductions in the prevalence of ischaemic heart disease, cerebrovascular disease, depression, dementia, and diabetes, while at the same time reducing transport–related greenhouse gas emissions and, hence, contributing to climate change mitigation.

[1] Promoting healthy and ecologically sensitive lifestyles means raising awareness among patients and giving recommendations to patients on how to live a healthier and ecologically more sensitive life.

Moreover, using low–emissions household cook stoves technology for burning of local biomass fuels in poor countries improves both human health, e.g. by reducing premature deaths from acute lower respiratory infections, ischaemic heart disease and chronic obstructive pulmonary disease, and ecosystem health, by lowering household energy–related greenhouse gas emissions (Wilkinson et al., 2009).

Furthermore, environment and human health benefits can be realized through a reduction of food consumption from livestock while ensuring that the nutritional requirements of populations that might benefit from consumption of some foods from animal sources are not compromised. As pointed out by Friel et al. (2009), such a strategy would decrease both greenhouse gas emissions from agriculture and the prevalence of ischaemic heart disease in humans (although livestock products are a source of some essential nutrients, they provide large amounts of saturated fat, which is a known risk factor for cardiovascular disease).

Healthy and ecologically sensitive lifestyles are also those ways of living which rely on the consumption of organic food and sustainable agricultural practices (e.g. agricultural practices that use less or no pesticides at all). Societies who foster the use of sustainable agriculture and the consumption of organic food will be able to improve soil biodiversity, which is a key supporting ecosystem service, while at the same time reducing the risk of diseases caused by pests and pathogens, less nutritious food, and the lack of clean water and air. Moreover, health risks for farmers and their families from pesticide exposure will be diminished (Wall et al., 2015; Panuwet et al., 2012; Atreya et al., 2012).

Furthermore, the consumption of “green” household products (including furniture, baby products, mattresses, textiles, electronics, food packaging, and housing insulation) has positive effects on both human and ecosystem health, as conventional household products often contain environmentally harmful toxicants (e.g. flame retardants) which have adverse health effects including endocrine disruption, reproductive toxicity, developmental neurotoxicity, and cancer (Shaw et al., 2014).

Finally, spending time (leisure time, holidays, etc.) in biologically diverse environments (parks, wild nature, ecologically diverse/green residential areas) has positive effects on human health in terms of psychological, cognitive, physiological, social and spiritual benefits (Sandifer et al., 2015) while at the same time having a potential indirect positive effect on environmental protection by raising the awareness of and dedication to natural resources.

Criteria for the evaluation of existing studies

The present literature review is a systematic review which is expected to identify existing research gaps with regards to the role of health practitioners in the promotion of ecologically sensitive lifestyles. Thomson Reuters Web of Science and Google Scholar were searched for articles published from 2000 through January 2016 using a range of alternative search terms for "health practitioners", "environment" and "health". Moreover, the reference lists of all relevant identified academic papers were screened in order to search for further relevant publications.

For the evaluation of those studies which were found to be eligible to be included in this literature review the following criteria were used:

1. Subjects of investigation: The group of health practitioners comprises different types of professionals including, to list just a few examples, physicians, pharmacists, nurses, surgeons, psychologists, clinical officers, social workers and managers of healthcare services. This diverse group of experts works in different health care access points, such as hospitals, healthcare centers and informal healthcare institutions, but also in health care and promotion research and administration. All of them are potential catalysts for the promotion of healthy and ecologically sensitive lifestyles and therefore relevant for the inclusion in respective studies. In this review, health practitioners are categorized into three groups: (i) medical practitioners and nurses (including any health professional, such as physicians, surgeons and nurses, who studies, diagnoses, and treats diseases, injuries, and other physical and mental impairments), (ii) health care administrators (including any leader, manager or administrator of public health systems, health care systems and hospitals), and (iii) other stakeholders (including any expert or non–expert who is not working in the health sector, but has an interest in or an impact on the way the health sector works).

2. Methodological approach: A range of methods may be applied in investigating the role of health practitioners in promoting healthy and ecologically sensitive lifestyles. On the one hand, quantitative studies offer the opportunity to quantify perceptions, attitudes, knowledge and behaviors, to transform survey data into statistics, and to generalize results from a larger sample population. Within the realm of statistics, the portfolio of statistical techniques to be used is large. On the other hand, qualitative research approaches allow enumerators to flexibly interview respondents and give interviewees the opportunity to talk about their opinions and actions in a narrative way, thus leading to a more holistic picture. Moreover, different modes of data collection and different sampling strategies resulting in different sample sizes can be applied. In this review, studies are categorized by (i) their use of either quantitative or qualitative research methods, (ii) the mode of data collection applied, and (iii) their sample size.

3. Geographical scope: Health care and health promotion systems worldwide differ substantially in capacity and organization. Accordingly, the role which health practitioners in different geographical places play in the promotion of health–environment co–benefits may differ. This is likely to be particularly true when comparing high, medium and low income countries. In this review, studies are categorized by the country on which their research focused.

4. Study focus: Improving our understanding of the current and potential role of health practitioners in the promotion of healthy and ecologically sensitive lifestyles requires multi–faceted research. In this literature review, studies are categorized by their study focus (or foci if more than one) using a range of categories which centre around the perception, knowledge, attitude, actions of health practitioners with regards to the linkages between environmental and population health, and the promotion of respective co–benefits.

Studies on the role of health practitioners in promoting healthy and ecologically sensitive lifestyles should ideally involve a wide range of relevant subjects, be diverse in their methodological approaches, and cover diverse geographical conditions. In the remainder of this article, existing studies will be evaluated based on primarily these four criteria, though further important characteristics will be reported in addition to that.

Review of existing studies

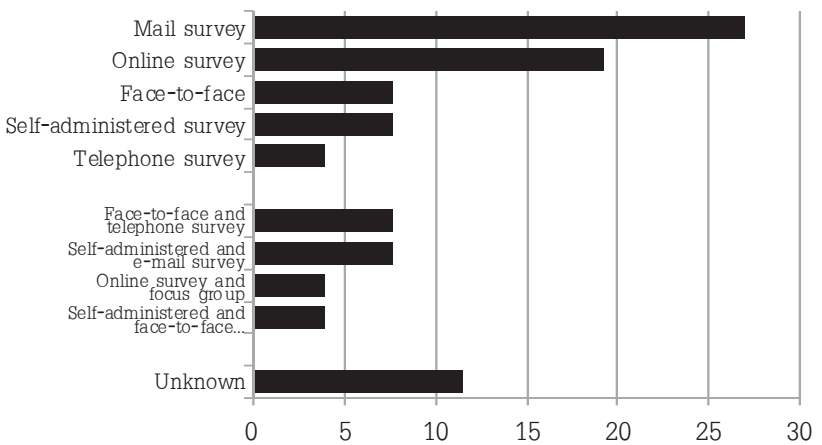
A total number of 26 studies were reviewed as shown Table 1 which gives an overview of the reviewed articles, their geographical scope and the subjects studied. Among the reviewed studies, the vast majority focused on the United States while only a very small share aimed at other parts of the world. In particular, low–and middle–income countries appear to be under–represented. There is also a strong focus on medical practitioners and nurses who were the subjects of investigation of most studies. Among the medical practitioners studied, pediatricians were the most frequent subjects of investigation. However, overall studies aimed at medical practitioners from different field of specialization. Only a comparatively small number of articles interviewed health care administrators, including, among others, senior managers of hospitals, and local, provincial and federal health officials. Other stakeholders, such as parents of pediatric patients, and government officials in environment and conservation were only investigated by three of the studies reviewed. The sample size of most studies ranged between 100 and 700 respondents, although there are a few studies with sample sizes below 100 interviewees and one study with an exceptionally large sample size of 2,536.

Table 1 Reviewed studies, geographical scope of studies, subjects studied and sample size

Study	Study location	Medical practitioners and nurses	Health care administrators	Other stakeholders	Sample size
Patrick et al. (2011)	Australia		X		14
Patrick and Kingsley (2015)	Australia		X		93
Murshed et al. (2004)	Bangladesh	X	X		59
Paterson et al. (2012)	Canada		X	X	52
Buka et al. (2006)	Canada	X		X	35
Trasande et al. (2014)	China	X			695
Abbas and Alghobashy (2012)	Egypt	X			56
Nicotera et al. (2006)	Italy	X			281
Stevens et al. (2004)	U.K.	X		X	278
Bedsworth (2012)	U.S.		X		61
Maibach et al. (2008)	U.S.		X		133
Polivka et al. (2012)	U.S.	X	X		143
Syal et al. (2011)	U.S.		X		225
Truckner (2009)	U.S.	X			665
Kilpatrick et al. (2002)	U.S.	X			266
Hawkins et al. (2015)	U.S.	X			570
Balbus et al. (2006)	U.S.	X			203
Karr et al. (2006)	U.S.	X			49
Trasande, Schapiro et al. (2006)	U.S.	X			277
Trasande, Boscarino et al. (2006)	U.S.	X			267
Trasande et al. (2010)	U.S.	X			362
Stotland et al. (2014)	U.S.	X			2536
Van Dongen (2002)	U.S.	X			173
Hamilton et al. (2005)	U.S.	X			350
Roberts et al. (2013)	U.S.	X			367
Beaudet et al. (2011)	Vietnam	X			141

The reviewed studies used different modes of data collection (see Figure 1). Most studies relied on mail and online surveys, while a smaller percentage conducted face–to–face interviews or used self–administered survey. Telephone surveys were the least frequent mode of data collection. Some of the studies combined different modes of data collection.

Figure 1 Data collection modes used (% of studies reviewed)



Regarding the choice between quantitative and qualitative methods, most the studies reviewed used quantitative surveys, collecting data by means of structured questionnaires with closed–

ended question (42%). A smaller share of studies employed qualitative methods, such as in–depth interviews and focus groups (8%). About 35% of all studies combined quantitative and qualitative research approaches.

Figure 2 Share of studies applying quantitative and qualitative methods

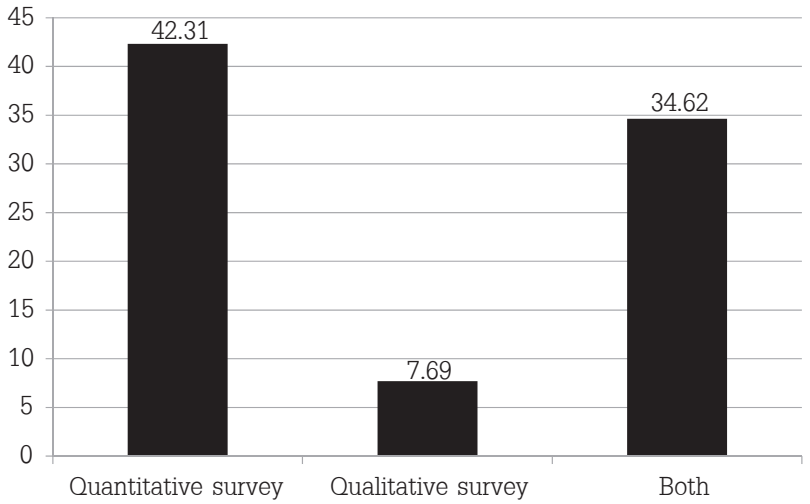
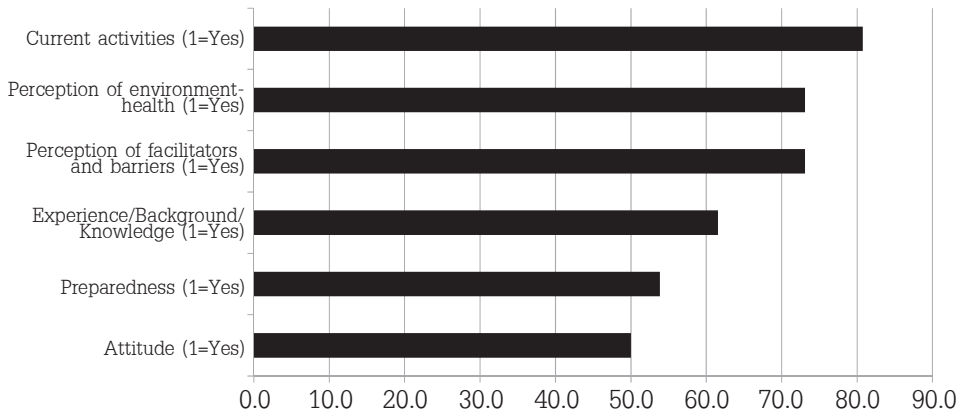


Figure 3 breaks down the research foci of the reviewed studies. The most frequently investigated aspect was the current state of health practitioners' or health institutions' active engagement in addressing environment–health–related issues. More than 80% of the reviewed studies focused on this aspect, investigating different types of activities. The practice of medical practitioners and nurses to ask patients about their environmental history was examined by a large number of studies (e.g. Trasande, Schapiro et al., 2006; Trasande, Boscarino et al., 2006; Trasande et al., 2010; Trasande et al., 2014; Abbas and Algobashi, 2012; Nicotera et al., 2006; Stotland et al., 2014; Balbus et al., 2006; Kilpatrick et al., 2002). Some authors, furthermore, assessed the involvement of respondents' institutions in specific environmental risk management programs or activities. Maibach et al. (2008), for instance, studied what activities local public health departments currently perform in order to avoid future climate change. The provision of information about environment–related health risks to patients and the promotion of healthy and environmentally sensitive lifestyles by medical practitioners and nurses was examined, for example, by Truckner (2009) who assessed whether health practitioners provide information about human–induced environmental degradation to patients, and Hawkins et al. (2015) who analyzed the promotion of vegetarian and vegan diets as a climate change mitigation strategy by pediatricians.

More than 70% of all reviewed studies explored the perception of health practitioners regarding (i) the linkages between environmental health and human health, and (ii) facilitators of

and barriers to a more effective prevention or mitigation of environment–related human health risks. Authors who studied how health practitioners perceive environment–health linkages assessed their level of concern regarding adverse effects of environmental problems on human health, and their perception of the importance of such problems (e.g. Bedsworth, 2012; Hawkins et al., 2015; Maibach et al., 2008; Paterson, 2012; Buka et al., 2006; Kilpatrick et al., 2002; Nicotera et al., 2006; Stevens et al., 2004; Stotland et al., 2014; Truckner, 2009). Studies that focused on facilitators of and barriers to a more effective prevention or mitigation of environment–related human health risks investigated this aspect both at the institutional level, example, Maibach et al. (2008) who explored local health departments' needs for resources which can help to better address climate change, and the individual level, instance, Abbas and Algobashi (2012) who examined reasons for the lack of environmental history taking by pediatricians.

Figure 3 Research foci of reviewed studies (% of reviewed studies)



The experience and background of health practitioners and their institutions in addressing environment–health linkages, and their respective knowledge, was the research focus of more than 60% of the reviewed studies. These studies investigated, for instance, how often medical doctors see patients with certain environment–related diseases (e.g. Murshed et al., 2004), whether they had received specific trainings regarding environment–health linkages (e.g. Murshed et al., 2004; Trasande et al., 2014; Abbas and Algobashi, 2012; Karr et al., 2006; Stotland et al., 2014; Hamilton et al., 2005) or the self–perceived level of knowledge of health practitioners concerning environment–health linkages and strategies to address these linkages (e.g. Murshed et al., 2004; Abbas and Algobashi, 2012; Nicotera et al., 2006; Balbus et al., 2006; Trasande, Schapiro et al., 2006; Trasande, Boscarino et al., 2006).

More than 50% of the studies included in this review explored the preparedness of health practitioners and their institutions to address environment–health linkages. This was done mostly by asking respondents about their self–perceived ability to diagnose and finding treatments for environment–related illnesses (e.g. Kilpatrick et al., 2002; Murshed et al., 2004; Trasande, Schapiro et al., 2006), self–efficacy in taking patients' environmental history (e.g. Kilpatrick et al., 2002) and general confidence to discuss environment–health linkages with patients (e.g. Kilpatrick et al., 2002; Karr et al., 2006; Trasande, Schapiro et al., 2006; Trasande, Boscarino et al., 2006). Moreover, respondents were asked to judge the preparedness of certain health institutions including local health departments and nursing divisions to address potential health impacts of environmental problems (e.g. Maibach et al., 2008; Polivka et al., 2012).

Finally, about half of the reviewed studies investigated respondents' attitudes towards the role of health practitioners in addressing health–related impact of environmental problems. These studies assessed, for instance, the viewpoints of health practitioners, health administrators and other stakeholders with regards to the desirable role of health practitioners in (i) the management of arsenicosis (Murshed et al., 2004) and (ii) addressing health–related impacts of climate change (Polivka et al., 2012). These studies also asked health practitioners about their opinion regarding potential positive effects and negative effects of such an engagement of health practitioners (e.g Trasande, Schapiro et al., 2006; Trasande, Boscarino et al., 2006; Stotland et al., 2014).

Discussion and conclusions

This literature review provided an overview of studies about the role of health practitioners with regards to the promotion of co–benefits between environmental conservation and population health promotion. One of the key findings is that the geographical focus of the reviewed studies is narrow with most studies focusing on the United States and only very few studies investigating this topic in low–or middle–income countries. This narrow focus stands in stark contrast to the often profound differences in health systems between developed and developing countries which make research findings from high–income countries difficult to transfer to developing economies. Among other factors, health systems in low–or middle–income countries often suffer from a lack of financial resources, a shortage of well–qualified staff and difficult political environments (Bloom et al., 2012; Gaimard, 2014), all of which may affect the role of health practitioners in promoting environment–health co–benefits. Further research in developing countries is therefore needed in order to generate a geographically more diverse body of empirical evidence on this subject matter.

A further important finding of this review is the widespread neglect of stakeholders outside the health sector. In fact, in most of the reviewed studies either medical practitioners, nurses

or health care administrators were interviewed, all of which are, of course, key players in the promotion of environment–health co–benefits by the health sector. Including stakeholders from other sectors can be very helpful, though, as demonstrated by the research of Paterson et al. (2012), who showed that experts from other fields, such as environmental planning and municipal planning can provide information that is crucial for designing health systems which more effectively account for environment–related human health risks and benefits. It is, thus, highly desirable to include experts from relevant other sectors in addition to stakeholders from inside the health sector in future surveys. A particularly important groups of stakeholders includes experts and decision makers from the field of environmental conservation whose consideration may generate further important insights in how environment–health linkages may be more effectively addressed by the health sector.

The methodological approaches of the reviewed studies are diverse. Sample sizes vary strongly and different modes of data collection were used. Most of the reviewed studies relied on less personal modes of data collection, including mail, online, self–administered and telephone surveys. Only a small share of the reviewed studies applied face–to face interviews. The diversity of data collection modes used can be viewed as a positive characteristic of current research as these modes differ in terms of a number of advantages and disadvantages, including, for instance, the possibility to reduce costs and reach a larger sample through mail and online surveys, and the strength of face–to–face interviews in terms of allowing for probing and clarification of respondents' answers. Similarly to the wide range of data collection modes applied, both quantitative, qualitative and mixed research approaches were followed by the reviewed studies, all of which offer distinct benefits and shortcomings. Since almost all of the quantitative studies reviewed used descriptive statistics or univariate inferential statistics only, another potential field for future research might be the use of multivariate statistical techniques in order to explore possible causal relationships between psychosocial and institutional characteristics of health practitioners and their engagement in the promotion of healthy and environmentally sensitive lifestyles.

With regards to the research foci addressed, investigating health practitioners' current activities at the interface between population and ecosystem health was the most frequent focus, followed by assessing the perception of health practitioners with regards to the linkages between population and ecosystem health, and the facilitators of and barriers to a more effective consideration of these linkages in their work or by the health sector in general. Slightly fewer studies looked at the level of experience and knowledge that health practitioners have with regards to addressing environment–related risks in their work with patients. Only about half of the reviewed studies investigated the self–perceived level of preparedness of health practitioners to engage in this field and their attitude to the topic. Overall, this finding suggests that there is a need to address multiple aspects when investigating the current and potential role of health practitioners in

promoting healthy and ecologically sensitive lifestyles which describe the level and determinants of their engagement. Moreover, further research foci can be envisioned, which were not addressed by the reviewed articles, including investigating the trade–off between conventional patient consultation tasks and the promotion of environment–health co–benefits by health practitioners with tight time constraint. Assessing how the relationship between different groups of practitioners, and the relationship between practitioners and patients affects the promotion of environment–health co–benefits might be another potential avenue of research.

In conducting this literature review, only articles published in English which appear in either Thomson Reuters Web of Science or Google Scholar were considered. Additional relevant articles might be available in other languages or other data bases. Future research could include such articles to obtain a more complete overview of current research gaps. Furthermore, future studies might explore additional characteristics of the reviewed articles such as the composition of the survey samples in terms of age, sex, working position and other relevant factors.

References

Abbas, R.A. & Alghobashy, A.A. (2012). Effect of an environmental health educational programme for paediatricians in an Egyptian university hospital: Before and after study. *JRSM Short Rep* 3.

Atreya, K., Johnsen, F. H., & Sitaula, B. K. (2012). Health and environmental costs of pesticide use in vegetable farming in Nepal. *Environment, Development and Sustainability*, 14(4), 477–493.

Balbus, J. M., Harvey, C. E., & McCurdy, L. E. (2006). Educational needs assessment for pediatric health care providers on pesticide toxicity. *Journal of Agromedicine*, 11(1), 27–38.

Beaudet, N. J., Alcedo, G. C., Nguyen, Q. C., Jacoby, D., Kieu, Q., & Karr, C. J. (2011). Children's environmental health experience and interest among pediatric care providers in Vietnam. *Journal of Health and Pollution*, 1(2), 24–36.

Bedsworth, L. (2012). California's local health agencies and the state's climate adaptation strategy. *Climatic Change*, 11(1), 119–133.

Bloom DF, Mahal A, Rosenberg L (2012). Design and operation of health systems in developing countries. *Global Population Ageing: Peril or Promise?*, 65–68.

Buka, I., Rogers, W. T., Osornio–Vargas, A. R., Hoffman, H., Pearce, M., & Li, Y. Y. (2006). An urban survey of paediatric environmental health concerns: Perceptions of parents, guardians and health care professionals. *Paediatrics & Child Health*, 11(4), 235.

Campbell, K., Cooper, D., Dias, B., Prieur–Richard, A.–H., Campbell–Lendrum, D., Karesh, W. B., & Daszak, P. (2012). Strengthening international cooperation for health and biodiversity. *EcoHealth*, 8(4), 407–409. http://doi.org/10.1007/s10393–012–0764–8

Daly, H. E. & Farley, J. (2011). *Ecological economics: principles and applications.* Washington, DC: Island Press.

Friel, S., Dangour, A. D., Garnett, T., Lock, K., Chalabi, Z., Roberts, I., ... & Haines, A. (2009). Public health benefits of strategies to reduce greenhouse–gas emissions: food and agriculture. *The Lancet*, 374(9706), 2016–2025.

Gaimard, M. (2014). Health systems in developing countries. In *Population and Health in Developing Countries* (pp. 119–139). The Netherlands: Springer.

Hamilton, W. J., Ryder, D. J., Cooper Jr, H. P., Williams, D. M., & Weinberg, A. D. (2005). Environmental health: a survey of Texas primary care physicians. *Texas Medicine*, 101(10), 62–70.

Hansen–Ketchum, P. A., & Halpenny, E. A. (2011). Engaging with nature to promote health: bridging research silos to examine the evidence. *Health Promotion International,* 26(1), 100–108.

Hawkins, I. W., Balsam, A. L., & Goldman, R. (2015). A survey of registered dietitians' concern and actions regarding climate change in the United States. *Frontiers in Nutrition*, 2.

Karr, C., Murphy, H., Glew, G., Keifer, M. C., & Fenske, R. A. (2006). Pacific Northwest health professionals survey on pesticides and children. *Journal of Agromedicine*, 11(3–4), 113–120.

Kilpatrick, N., Frumkin, H., Trowbridge, J., Escoffery, C., Geller, R., Rubin, L., ... & Nodvin, J. (2002). The environmental history in pediatric practice: a study of pediatricians' attitudes, beliefs, and practices. *Environmental Health Perspectives*, 110(8), 823.

Maibach, E. W., Chadwick, A., McBride, D., Chuk, M., Ebi, K. L., & Balbus, J. (2008). Climate change and local public health in the United States: Preparedness, programs and perceptions of local public health department directors. *PLoS ONE*, 3(7), e2838.

Markandya, A., Armstrong, B.G., Hales, S., Chiabai, A.,Criqui, P., Mima, S., Tonne, C. & Wilkinson, P. (2009). Public health benefits of strategies to reduce greenhouse–gas emissions: low–carbon electricity generation. *The Lancet*, 374(9706), 2006–2015.

Millennium Ecosystem Assessment (2005). *Ecosystems and human well–being: Synthesis.* Washington, DC: Island Press.

Murshed, R., Douglas, R. M., Ranmuthugala, G. & Caldwell, B. (2004). Clinicians' roles in management of arsenicosis in Bangladesh: Interview study. *BMJ*, 328(7438), 493–494.

Nicotera, G., Nobile, C.G., Bianco, A. & Pavia, M. (2006). Environmental history–taking in clinical practice: Knowledge, attitudes, and practice of primary care physicians in Italy. *J. Occup. Environ. Med.* 48, 294–302.

Paterson, J. A., Ford, J. D., Ford, L. B., Lesnikowski, A., Berry, P., Henderson, J., & Heymann, J. (2012). Adaptation to climate change in the Ontario public health sector. *BMC Public Health,* 12(1), 452. http://doi.org/10.1186/1471–2458–12–452

Patrick, R., Capetola, T., Townsend, M. & Hanna, L. (2011). Incorporating Sustainability into community–based healthcare practice. *EcoHealth*, 8(3), 277–289.

Patrick, R. & Kingsley, J. (2015). Exploring Australian health promotion and environmental sustainability initiatives. *Health Promotion Journal of Australia*.

Polivka, B. J., Chaudry, R. V., & Mac Crawford, J. (2012). Public health nurses' knowledge and attitudes regarding climate change. *Environmental Health Perspectives*, 120(3), 321–325.

Roberts, J. R., Karr, C. J., De Ybarrondo, L., McCurdy, L. E., Freeland, K. D., Hulsey, T. C., & Forman, J. (2013). Improving pediatrician knowledge about environmental triggers of asthma. *Clinical Pediatrics* 52(6), 527–533.

Romanelli, C., Corvalan, C., Cooper, H. D., Manga, L., Maiero, M., & Campbell–Lendrum, D. (2014). From Manaus to Maputo: Toward a public health and biodiversity framework. *EcoHealth,* 11(3), 292–299.

Sandifer, P. A., Sutton–Grier, A. E., & Ward, B. P. (2015). Exploring connections among nature, biodiversity, ecosystem services, and human health and well–being: Opportunities to enhance health and biodiversity conservation. *Ecosystem Services,* 12, 1–15. http://doi.org/10.1016/j.ecoser.2014.12.007

Shaw, C., Hales, S., Howden–Chapman, P., & Edwards, R. (2014). Health co–benefits of climate change mitigation policies in the transport sector. *Nature Climate Change*, 4(6), 427–433.

Stevens, E., Cullinan, P., & Colvile, R. (2004). Urban air pollution and children's asthma: What do parents and health professionals think? *Pediatric Pulmonology*, 37(6), 530–536.

Stotland, N. E., Sutton, P., Trowbridge, J., Atchley, D. S., Conry, J., Trasande, L., & Woodruff, T. J. (2014). Counseling patients on preventing prenatal environmental exposures–a mixed–methods study of obstetricians. *PloS One*, 9(6), e98771.

Syal, S. S., Wilson, R. S., Mac Crawford, J., & Lutz, J. (2011). Climate change and human health—what influences the adoption of adaptation programming in the United States public health system?. *Mitigation and Adaptation Strategies for Global Change*, 16(8), 911–924.

Trasande, L., Niu, J., Li, J., Liu, X., Zhang, B., Li, Z., ... & Chen, L. C. (2014). The environment and children's health care in Northwest China. *BMC Pediatrics*, 14(1), 1.

Trasande, L., Newman, N., Long, L., Howe, G., Kerwin, B. J., Martin, R. J., ... & Weil, W. B. (2010). Translating knowledge about environmental health to practitioners: are we doing enough?. *Mount Sinai Journal of Medicine: A Journal of Translational and Personalized Medicine,* 77(1), 114–123.

Trasande, L., Schapiro, M. L., Falk, R., Haynes, K. A., Behrmann, A., Vohmann, M., ... & Landrigan, P. J. (2006). Pediatrician attitudes, clinical activities, and knowledge of environmental health in Wisconsin. *WMJ–MADISON–*, 105(2), 45.

Trasande, L., Boscarino, J., Graber, N., Falk, R., Schechter, C., Galvez, M., ... & Miller, R. K. (2006). The environment in pediatric practice: A study of New York pediatricians' attitudes, beliefs, and practices towards children's environmental health. *Journal of Urban Health*, 83(4), 760–772.

Truckner, R. T. (2009). Health care provider beliefs concerning the adverse health effects of environmental and ecosystem degradation. *Wilderness & Environmental Medicine*, 20(3), 199–211.

United Nations General Assembly (2015). Resolution adopted by the General Assembly on 25 September 2015. Retrieved October 21, 2015, from http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

Van Dongen, C. J. (2002). Environmental health and nursing practice: A survey of registered nurses. *Applied Nursing Research*, 15 (2), 67–73.

Wall, D. H., Nielsen, U. N., & Six, J. (2015). Soil biodiversity and human health. *Nature*, 528, 69–76.

WHO. (1986). Ottawa Charter for Health Promotion. Geneva, Switzerland: WHO.

WHO. (2005). *Ecosystems and human well–being: Health synthesis.* Retrieved December 15, 2015 from http://www.who.int/globalchange/ecosystems/ecosystems05/en/

WHO. (2012). Our planet, our health, our future. Human health and the Rio Conventions. Discussion Paper.

WHO. (2016, March 16). The top 10 causes of death. Retrieved December 15, 2015 from http://www.who.int/mediacentre/factsheets/fs310/en/

Wilkinson, P., Smith, K. R., Davies, M., Adair, H., Armstrong, B. G., Barrett, M., ... & Ridley, I. (2009). Public health benefits of strategies to reduce greenhouse–gas emissions: household energy. *The Lancet*, 374(9705), 1917–1929.

Woodcock, J., Edwards, P., Tonne, C., Armstrong, B. G., Ashiru, O., Banister, D., .. & Franco, O. H. (2009). Public health benefits of strategies to reduce greenhouse–gas emissions: urban land transport. *The Lancet*, 374(9705), 1930–1943.