



# Evidence and ideology as a rationale for light-therapy in Russia: from the Soviet Union to the present day

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## DECLARATIONS

### Competing interests

The authors declare no conflict of interest or competing financial interest. An earlier version of this paper was written as part of Charlotte Kühlbrandt's MSc dissertation project at the London School of Hygiene and Tropical Medicine.

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MM had the idea for the study. CK conducted the literature

## Summary

Light therapy is still used to treat a number of common diseases in Russia. The practice is firmly anchored in history: Soviet clinical practice was divorced from the emerging field of evidence-based medicine. Medical researchers were cut off from international medical research and scientific literature, with much Soviet scientific activity based on a particular socialist ideology. In this study, the use of light therapy serves as a case study to explore tensions between international evidence-based medicine and practices developed in isolation under the Soviet Union, the legacy of which is to the detriment of many patients today. We used four different search methods to uncover scientific and grey literature, both historical and contemporary. We assessed the changing frequency of publications over time and contrasted the volume of literature on light therapy with more orthodox treatments such as statins and painkillers. Our search found an increasing number and comparatively large body of scientific publications on light therapy in the Russian language, and many publications emanating from prestigious Russian institutions. Combined with our analysis of the historical literature and our appraisal of 22 full text articles, this leads us to suggest that light therapy entered mainstream Soviet medical practice before the Stalinist period and still occupies an important position in contemporary Russian clinical practice. We propose that this outdated treatment survives in Russia in part due to the political, economic and social forces that helped to popularize it during Soviet times, and by the seeming justification offered by poorly executed studies.

## Background

The Journal of the Royal Society of Medicine previously reported how, in 1927, Dora Colebrook studied the effectiveness of light therapy for treating varicose ulcers and 'weedy' or 'sickly'

children but was unable to find any benefit. Though her studies initially met with great opposition from the British medical establishment, when she re-ran a similar study in 1946 it found acceptance. Nowadays, in western countries, light

review, collected and analysed the data, interpreted the results and drafted the paper. MM reviewed the paper and CK incorporated his comments for the final draft. We are grateful for the useful revisions suggested by Sviatoslav Plavinski.

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#### Provenance

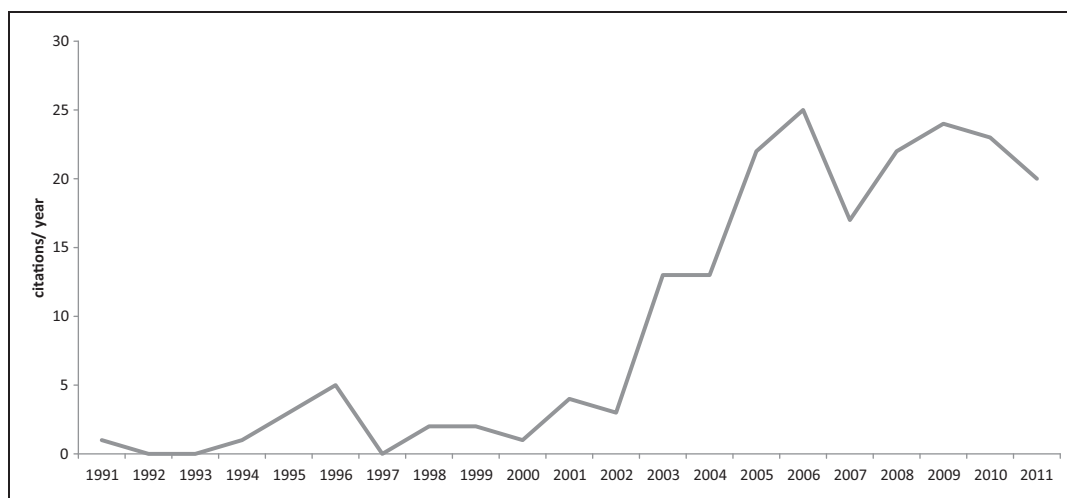
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therapy is only used by mainstream practitioners for a very small number of diseases where there is empirical evidence of benefit.<sup>1</sup> In Russia, in contrast, light therapy is still used to treat a number of common diseases, including hypertension, breast cancer and herpes simplex.<sup>2</sup> The practice is firmly anchored in history: during the Soviet era clinical practice was divorced from the international emergence of evidence-based medicine as medical researchers were cut off from international medical research and scientific literature, with much Soviet scientific activity based on a particular socialist ideology that appealed to historical authority.<sup>3</sup> In this study, the use of light therapy serves as a case study to explore the tensions between international evidence-based medicine and practices developed in isolation during the Soviet Union, the legacy of which is to the detriment of many patients today. Looking at evidence through the prism of Stalinism is illuminating because it goes to the root of the Russian treatment of empirical evidence, generating theories to explain the continuing absence of evidence-orientated clinical practice in Russia. A review of the history of light therapy in medicine under Stalin and of current Russian research may help to understand the use of evidence and ideology, the foundations for current practice and research, and the structures that have led to provision of medical care that is often ineffective, and potentially harmful.

## Methods

We conducted four different search methods: a manual search in the Russian State Library to uncover historical material; in Pubmed to identify contemporary full text articles for appraisal; a search on scholar.google.ru to assess the changing frequency of publications over time; and finally an indicative search across four databases to compare the volume of literature on light therapy with more orthodox treatments such as statins and painkillers.

A systematic search in the Russian State Library for publications on light therapy under Stalin (1929–1953) revealed nine publications. Each was analysed and key themes were identified across the literature. A systematic Pubmed search was conducted. The search strategy was (phototherapy [Title] OR 'light therapy' [Title]) AND Russian [Language]). This identified 26 Russian language articles on light therapy since the collapse of the Soviet Union (1991–2012). Four were excluded because they were unavailable, resulting in 22 papers. These were each evaluated using a template based on established principles of critical appraisal<sup>4</sup> that was simplified as it soon became clear that few papers complied with conventional study designs or contained sufficient information to make meaningful assessments. We identify continuities and change between the two bodies of literature, while



**Figure 1.** Results for light therapy in scholar.google.ru 1991–2011 (*fototerapiia/fototerapii*; *svetoterapiia/svetoterapii*; *svetolechenie/svetolecheniia* in titles), accessed 19 November 2012.

**Table 1.** Comparative search results for light therapy and other common treatments in Russian and English (column percentages), 1991–2012.

Treatment	Pubmed		Google Scholar		Ruskaia Meditsina	elibrary.ru
	Russian	English	Russian	English	Russian	Russian
Phototherapy	27 (15%)	1232 (7%)	204 (50%)	2820 (7%)	163 (23%)	102 (13%)
Light therapy	0 (0%)	327 (2%)	8 (2%)	872 (2%)	39 (6%)	26 (3%)
Atorvastatin	35 (19%)	2457 (13%)	35 (9%)	5820 (14%)	100 (14%)	133 (17%)
Simvastatin	31 (17%)	2746 (15%)	20 (5%)	6440 (15%)	87 (12%)	112 (14%)
Aspirin	63 (34%)	7671 (41%)	105 (26%)	15300 (36%)	221 (31%)	218 (28%)
Paracetamol	27 (15%)	1992 (11%)	22 (5%)	6080 (14%)	61 (9%)	109 (14%)
Ibuprofen	3 (2%)	2285 (12%)	14 (3%)	5630 (13%)	33 (5%)	84 (11%)

Note: Accessed 19 November 2012.

drawing on the history of Soviet medicine and science. The search on scholar.google.ru revealed 208 hits for the synonyms of light therapy (fototerapiia/fototerapii; svetoterapiia/svetoterapii; svetolechenie/svetolecheniia) in titles for the period 1991–2011 (Figure 1); we then searched for the same terms in four different databases (Google Scholar Russian and English; Pubmed Russian and English; Ruskaia Medicina and elibrary.ru) and compared the number of hits (1991–2013) when the search terms were included in titles with hits for names of common statins (atorvastatin and simvastatin) and common painkillers (aspirin, ibuprofen and paracetamol). The search strategy for Ruskaia Medicina used the truncated stem for each search term (and only searched within Russian language publications); Google automatically searched for all grammatical forms of the nouns. In elibrary.ru (journal articles, books, dissertations and reports) we searched separately for fototerapiia/fototerapii; svetoterapiia/svetoterapii; svetolechenie/svetolecheniia (Table 1).

### Light therapy in Soviet Russia

In the first half of the 20th century light therapy was popular all over Europe, including Russia, as well as the United States. However, while in the West the use of light therapy was slowly abandoned, except for a select number of diseases where there was evidence of effectiveness, its popularity in Russia has not waned. During Soviet times it was advocated for a list of diseases ranging from respiratory disorders, diseases of

internal organs, skin conditions to gynaecological complaints.<sup>5–7</sup>

In the West, the widespread use of light therapy was incompatible with the growing importance of scientific evidence to medicine. The concept of evidence in healthcare became linked to the idea of falsifiability, a philosophical concept developed by Karl Popper as a criticism of positivism. According to Popper, a useful hypothesis should be capable of being disproved by empirical experiment. The Soviet model of scientific reasoning continued to follow a more inductive approach where the goal was not to refute hypotheses but rather to gather evidence from experiments that would support them. This often involved the use of analogy and surrogate measures. Thus, if light therapy caused some other observable effect, such as inflammation, it was inferred that said effect would improve the outcome in question, even if there was no plausible causal pathway. This was in contrast with the Popperian approach of testing the null hypothesis, that 'light therapy has no effect on a given outcome'.

The Popperian concept can be seen in Archie Cochrane's *Effectiveness and Efficiency*,<sup>8</sup> which emphasized the importance of evaluating treatments by subjecting them to randomized controlled trials (RCTs).<sup>9</sup> His ideas 'had a profound impact on medicine, particularly on segments of public health and epidemiology'.<sup>10</sup> However, as he noted in *Effectiveness and Efficiency*, evidence-based medicine failed to be adopted in the Soviet Union, where different kinds of 'evidence'

counted in a treatment's favour: for instance whether it could be shown, however tangentially, to conform to the tenets of Marxism-Leninism, a process facilitated by books of quotations that could be used out of context. Ideological conformity was expedient for scientists who wished to be published, or in some cases even to survive, particularly during the apogee of Stalinism (1945–1953).<sup>11</sup>

But other economic constraints and political and social drivers also aided the popularity of light therapy. The use of artificial light (mostly UV and IR rays) instead of sunlight was encouraged by a general enthusiasm for technological advancement during the 1920s.<sup>12</sup> 'Communism' was, after all, 'Soviet power plus the electrification of the entire country,' as a huge sign on the banks of the river Moskva served to remind citizens in the early 1920s.<sup>13</sup>

In economic terms, light therapy provided a way that some treatment could be offered when the state could not afford or was unwilling to produce or import medicines available in the West. The production of lamps cannot have been cheap (with light bulbs up to 3000 W),<sup>6</sup> but it may have been more consonant with an infrastructure dedicated to heavy industrial and military production that never developed the capacity to produce innovative pharmacological products,<sup>14</sup> and, even if it could have done so, would have been unable to distribute them reliably to the population.<sup>15</sup>

In political terms, light therapy was viewed as an example of Soviet preventive medicine, which accommodated the yearning to provide an alternative model to capitalist science and medicine, and which has to be understood as a politico-economic undertaking:

the fundamental and principle hallmark of Soviet public health, differentiating it from medicine in capitalist countries, is its preventive orientation. The Soviet government's growth in prosperity, its successes in agricultural and cultural construction presents us with the full potential to conduct effective preventive operations with the goal of lowering morbidity and the elimination of its causes [...] Preventive medicine has deep roots in Russian medicine... the theoretical foundations for preventive operations can be traced

back to the scientists I.M. Sechenov and I.P. Pavlov (1952).<sup>16</sup>

Elsewhere a Marxist history of light therapy was presented: it was factory workers who had allegedly observed the beneficial effects of light on their health, specifically on pain relief from rheumatic and neuralgic symptoms, and who subsequently brought this to the attention of the administration. Thus, light therapy was not like any other treatment; it was considered both Russian and proletarian in origin. What better treatment could there be for the Russian proletariat?

In social terms light therapy promised an avenue to exploit cutting edge technology for the improvement of the life of the masses. In theory, mass UV irradiators (*fatarii*) were to be built everywhere (particularly in the North), but priority was to be given to 'workers, who under their working conditions have little opportunity to make full use of natural sun-light, for example those working underground'. They 'should be built in administrative-social (*bytovye*) industrial complexes of coal mines', the metal industry, in 'a range of factories and plants, in vocational training schools, trade schools, and furthermore in gyms and so on and so on'.<sup>16</sup> In the proposed format for these *fatarii* 'the irradiated are placed on a 40m conveyor belt, which moves between two rows of rutno-quartz lamps and incandescent lamps'. In this manner all those who are irradiated receive the same dose, depending on the speed of the conveyor belt.

Thus, light therapy seems to have entered mainstream Soviet medical practice before the Stalinist period. Yet it still occupies an important position in contemporary Russian clinical practice; its adoption may in part be attributable to its political, economic and social compatibility with Stalinism. But even today the number of diseases for which light therapy has been recommended is not much shorter than during Soviet times, ranging from stomach ulcers to ischemic heart disease, from Alzheimer's to Parkinson's disease.<sup>17</sup> We next explore why this might be so, seeking to initiate the debate and raise pertinent questions. A full account of the role of light therapy in Soviet and later Russian medicine is beyond the scope of this brief paper.

## Light therapy in contemporary Russia

How do we know that light therapy is still part of Russian medical practice, and not just the prerogative of a small group of fringe medical practitioners, as it is in the West? Clearly, a systematic survey of health facilities would be needed to establish the precise extent of light therapy in contemporary Russia, but for now we can glean insights from the most easily accessible literature. First, our comparative search for light therapy across four databases found a disproportionately large body of literature on light therapy when compared with the ratio of light therapy to more established treatments in the English language. The number of Russian publications on light therapy was roughly equal to or outweighed by publications on such common treatments as paracetamol, while the opposite was clearly the case in the English literature (Table 1). Second, our search of literature on Russian Google Scholar over the period 1991–2011 shows a substantial increase in the number of publications. However, these data should be interpreted with care: there may be some duplicates and some misclassification of other forms of therapy such as laser therapy or photodynamic light therapy. Nevertheless, the figures are indicative of the changing volume of literature. Third, we see that contemporary research on light therapy indexed on *Pubmed* emanates from prestigious and government-funded research institutes, such as the Russian Scientific Centre of Radiology and Surgical Technology of the Ministry of Health and Social Development in St. Petersburg,<sup>18</sup> the Moscow Regional Research and Clinical Institute (MONIKI),<sup>17–19</sup> the Paediatric Department in the Russian State Medical University in Moscow,<sup>20</sup> the Research Institute for Paediatric Oncology and Haematology of the Russian Academy of Medical Sciences,<sup>21</sup> the Department of Nervous Diseases in the Faculty for Post-graduate Professional Training in the Russian State Medical University,<sup>20,22,23,24</sup> and other similar institutions. Light therapy research is evidently not produced peripherally, but in the most renowned Russian medical institutions.

The repeated validation of biologically implausible findings begs the question of whether results have been intentionally manipulated, or

whether the study designs that we see in the *Pubmed*-indexed literature are too poor to produce a valid outcome. It is doubtful whether any of the study designs reviewed would hold up to criteria for publication in Western medical journals (Box 1). Sample sizes vary from  $n = 548^{21}$  to  $n = 4^{26}$ ; but hardly any consideration is given to statistical analysis of the results (and even less to its interpretation), and experimental designs consistently lack explicit case definitions; only two of the studies reviewed claim to be randomized, though the format and content of many studies clearly calls for it, and the role of comparison groups is on the whole vague and undefined. The studies we reviewed continued to use surrogate rather than clinical outcomes, without noting this obvious limitation in their analysis or conclusions.

The two examples in Box 1, which are typical of those reviewed, underline how some design elements follow standard epidemiological protocols (for example, the notions of control groups and statistical analysis at the  $p < 0.05$  level), and how other elements are totally absent, such as the attempt to minimize systematic bias, or ethical considerations of patient consent or risk to subjects (resulting, for example, from extracorporeal circulation of blood exposed to blue light). The implicit case definitions in these two studies are extremely vague: for example 'psychoautonomous disorders of neurological nature' is not indexed in the ICD-10, and is not further described, except that symptoms range from depression to obesity, from migraine to ovarian dysfunction. In both examples some of the outcome measures may be inappropriate for the intervention: the biological effect of visible blue light on 'blood viscosity' is highly questionable, given the absence of any plausible link between blood viscosity and cardiovascular disease, although many Russian traditional treatments of hypertension are based on the idea that it is caused by increased viscosity.<sup>27</sup>

## Conclusions

There are only a few studies of Russian prescription and practice in the international literature. A facility survey, including interviews with Russian practitioners, would help to elicit the current use of light therapy. It is just possible that this might also identify areas where there is genuine

**Box 1.** Illustrative examples of study designs.Treatment under investigation:<sup>25</sup>

Phototherapy of haemorheological disorders in coronary failure, comparing standard treatment with 254 nm and 436 nm wavelength light therapy.

Methods:

Thirty-four patients were non-randomly allocated to three groups. Patients were recruited from an in-patient facility and presented with CHD, angina, diffuse cardio, atherosclerosis of the aorta and its branches, all of whom had elevated 'blood viscosity' levels (and concomitant diseases: 30 hypertensive heart disease; 10 obesity; eight chronic ischemia of the brain with stroke; five chronic bronchitis with pneumosclerosis; six diabetes; five chronic pancreatitis; four chronic pyelonephritis).

1. Control group:  $n = 10$ ; Standard medication (nitrosorbid, anaprilin, verapamil, kavinton, pentoksifilin, aspirin, etc.).
2. Treatment A:  $n = 16$  standard treatment in addition to extracorporeal auto-blood exposure to blue light, three to six sessions over two weeks.
3. Treatment B:  $n = 8$  standard treatment in addition to blood exposure to UV-light (treatment length or frequency not specified).

Blood viscosity measured as 'viscosity of whole blood and plasma, haematocrit and fibrinogen concentrations', using the Swiss-made machine: 'Low Shear'.

Results:

Results show that baseline levels of blood viscosity were elevated in comparison to the 'norm' in all three groups ( $p < 0.05$ ). The results table indicates that there was no significant difference in indicators of 'blood viscosity' between baseline and after treatment in the comparison group, or in Treatment B (UV-light). There is no statistical comparison between the comparison and the intervention groups.

Conclusion:

'Only blue light phototherapy produced a positive effect on blood viscosity due, primarily, to haematocrit reduction.'

Treatment under investigation:<sup>23</sup>

Rating the effect of phototherapy on 'psychoautonomic disorders of neurological nature' and to work out indications and contraindications for light therapy.

Methods:

Fifty-one patients with 'psychoautonomic disorders', 33 women; 18 men; average age 35 received light therapy (1 h bright light therapy daily for two weeks, 60 cm from lamp, 3300 lux). Sixteen patients received placebo therapy (1 h bright light, 3 m from lamp at 500 lux). The control group consisted of 10 healthy subjects. Clinical-neurological studies were conducted on them. Forty-three outcomes were measured, including neuro-endocrine, motivation, psychoautonomic, pain, psychopathologic, EEG spectrum, urine excretion of metabolites of catecholamines and serotonin.

Results:

'Improvement occurred in 52% of the patients (responders – group 1, nonresponders – group 2). Changes occurred in nearly all symptoms: neuroendocrine, motivation, psychoautonomic, pain, psychopathologic. After the treatment in group 1 there was an increase of power of EEG spectrum, intensification of manifestations of the slow activity and decrease of the fast one from the two sides, an approach of the coefficient of asymmetry to the control levels as well as elevation of the urine excretion of metabolites of both catecholamines and serotonin. Initially higher power of EEG spectrum in group 2 became still more increased due to intensification of manifestations of theta and beta-2 rhythms from the two sides. Meanwhile coefficient of asymmetry was sharply decreased as well as general secretory activity inhibited. There were such symptoms and indices which had changed either negatively or positively under the influence of phototherapy' (quoted from the English abstract).

Conclusion:

'[...] Phototherapy has a positive effect on the brain function [...].'

uncertainty about the efficacy of biologically plausible light therapy treatments, which could be subjected to RCTs.

The poor quality of study designs reported in this paper is consistent with how epidemiology, as understood in the West, has traditionally not been taught in Russian educational establishments.<sup>28,29</sup> The peer-review system in the journals examined is manifestly not designed to filter out poor quality study designs, government funding is not allocated to institutions according to the rigour of their research, nor is there an institutional body in Russia that promotes evidence-orientated clinical practice (such as the National Institute of Health and Clinical Excellence in the United Kingdom).

Many of the historical reasons for the non-acceptance of evidence-based medicine persist in contemporary Russia, with practice patterns carried over from Soviet times. Although the federal programme Health (*Natsional'nyi Proekt 'Zdorov'e'*) has improved the situation considerably, there are still problems of access to modern medicines. High-tech interventions lacking an evidence base (such as extracorporeal auto-blood exposure to blue light, or EEGs to measure brain activity after exposure to bright white light) are seen as more attractive than basic but effective generic medications. Politically, Russian exceptionalism still looms large over much medical research. Some authors are still at pains to demonstrate the fact that light therapy is a distinctly Russian therapy, developed by Russian scientists.<sup>17</sup> We propose that light therapy survives in Russia in part due to the political, economic and social forces that helped to popularize it during Soviet times, being justified by poorly executed studies.

Was there a Russian equivalent to Dora Colebrook? Even if, over the course of the 20th century, the social, political and economic environment in Russia had produced a similar figure, it is likely that they would have sunk into obscurity. As many studies from the James Lind Library testify,<sup>30</sup> early pioneers of evidence-based medicine are now celebrated in Britain because evidence-based medicine has become the dominant discourse in Western public health. Dora Colebrook's positive representation was facilitated by a new approach to evidence between Colebrook's first study of

light therapy in 1927 and her second in 1946. At this point such a change has not taken hold in Russia.

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