



Vscan™ Family Research Publications Bibliography

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 Vscan Family includes Vscan, Vscan with Dual Probe and Vscan Extend™

* Only supports Vscan with Dual Probe and Vscan Extend with Dual Probe.

GE is providing this list of peer-reviewed articles to help medical professionals understand the current state of research related to various devices, technologies, and applications. The use of the device in each publication is within the indications of use and intended use; however, the authors' conclusions are solely based on their scientific studies and must be evaluated by a medically qualified reader. GE does not endorse or support any conclusions or recommendations contained in these publications.

Vscan Family – Cardiology

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Cardiology				
Khandwalla & Kedan, Cedars-Sinai Heart Institute, Los Angeles, California, USA	Usefulness of Serial Measurements of Inferior Vena Cava Diameter by Vscan to Identify Heart Failure Patients at High Risk of Hospitalization	The American Journal of Cardiology, 2017	28442126	Increasing Inferior Vena Cava Diameter (IVCd) as measured by handheld ultrasound (HHU) at the point-of-care is associated with an increased risk of heart failure (HF) admission and may provide clinically useful information at the point-of-care to guide HF management.
Kobal & Siegel, Division of Cardiology, Soroka University Medical Center and Joyce and Irving Goldman Medical School, Ben-Gurion University of the Negev, Beer-Sheva, Israel Cedars-Sinai Heart Institute, Cedars-Sinai Medical Center and UCLA, Los Angeles, California, USA	Impact of Point-of-Care Ultrasound Examination on Triage of Patients with Suspected Cardiac Disease	The American Journal of Cardiology, 2016	27634025	In conclusion, during patient triage, extension of the physical examination by point-of-care ultrasound study (POCUS) can cause physicians to alter their initial diagnosis, resulting in an immediate change of diagnostic and therapeutic procedures. Based on POCUS results, physicians altered the diagnostic plan either by avoiding or referring patients to other diagnostic procedures in almost half of the studied population.
Gundersen & Dalen, Department of Medicine, Levanger Hospital, Nord-Trøndelag Health Trust, Levanger, Norway	Adding Point of Care Ultrasound to Assess Volume Status in Heart Failure Patients in a Nurse-Led Outpatient Clinic. A Randomised Study	Heart, 2016	26438785	Ultrasound examinations of the pleural cavities and Inferior Vena Cava (IVC) by nurses may improve diagnostics and patient care in Heart Failure (HF) patients at an outpatient clinic, but more studies are needed to determine whether these examinations have an impact on clinical outcomes.
* Nakanishi & Shimada, Department of Cardiovascular Medicine – Baba Memorial Hospital – Sakai, Japan	Detection of Deep Venous Thrombosis Using a Pocket-Size Ultrasound Imaging Device	JACC Cardiovascular Imaging, 2015	26363831	The accurate and immediate decision making allowed by the pocket-size ultrasound examination (PUE) has the potential to exert a significant impact on the current diagnostic strategies for DVT. Positive PUE can make other diagnostic or therapeutic procedures available earlier for the patient without standard ultrasound examination (SUE).

Vscan Family – Cardiology *(cont.)*

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Cardiology <i>(cont.)</i>				
Kini & Kirkpatrick, Cardiovascular Medicine Division, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania, USA	Focused Cardiac Ultrasound in Place of Repeat Echocardiography: Reliability and Cost Implications	Journal of the American Society of Echocardiography, 2015	26165448	Findings from expert Focused Cardiac Ultrasound (eFCU) correlate well with those from transthoracic echocardiography (TTE) when used in the setting of repeat testing for assessment of ventricular function, pericardial effusion, and inferior vena cava collapse. The judicious use of eFCU in place of repeat inpatient TTE has the potential to deliver quality cardiac imaging at reduced cost.
Gustafsson & Johansson, Department of Cardiology and Department of Medicine and Health Sciences, Linköping University, Linköping, Sweden	Imaging Congestion with a Pocket Ultrasound Device: Prognostic Implications in Patients with Chronic Heart Failure	Journal of Cardiac Failure, 2015	25725475	With the use of a hand-held ultrasound device, signs of pulmonary congestion could be demonstrated. When found, these had a significant prognostic impact in clinically stable heart failure (HF).
Graven & Dalen, Department of Medicine, Levanger Hospital, Nord-Trøndelag Health Trust, Levanger, Norway	Focused Ultrasound of the Pleural Cavities and the Pericardium By Nurses After Cardiac Surgery	Scandinavian Cardiovascular Journal, 2015	25611808 OPEN ACCESS	Cardiac nurses were able to obtain reliable measurements and quantification of both pericardial effusion (PE) and pleural effusion (PLE) bedside by focused ultrasound (US) and outperform the commonly used chest x-ray regarding PLE after cardiac surgery.
Di Bello & Carerj, University Cardio-angiology Departmental Section, Cisanello Hospital, AOUP, Pisa, Italy	Incremental Value of Pocket-Sized Echocardiography in Addition to Physical Examination during Inpatient Cardiology Evaluation: A Multicenter Italian Study (SIEC)	Echocardiography, 2015	25865022	Pocket-Sized Echocardiography (PSE) had an incremental diagnostic value during bedside cardiology consultation, increasing the number of appropriate diagnoses and reducing the routine use of echocardiography.
Khan & Topol, Division of Cardiovascular Diseases, Scripps Clinic, Scripps Health, La Jolla, California, USA	Can Hospital Rounds with Pocket Echocardiography by Cardiologists Reduce Standard Transthoracic Echocardiography?	The American Journal of Medicine, 2014	24674919	The results from rapid bedside pocket mobile echocardiography examinations performed by experienced cardiology fellows compared favorably with those from formal transthoracic echocardiography studies. For hospitalized patients, this finding could shift the burden of performing and interpreting the echocardiogram to the examining physician and reduce the number and cost associated with formal echocardiography studies.
Gustafsson & Johansson, Department of Cardiology and Department of Medicine and Health Sciences, University of Linköping, Sweden	Pocket-Sized Ultrasound Examination of Fluid Imbalance in Patients with Heart Failure: A Pilot and Feasibility Study of Heart Failure Nurses without Prior Experience of Ultrasonography	European Journal of Cardiovascular Nursing, 2014	25376773	After brief training, heart failure nurses can reliably identify pulmonary congestion and pleural effusion with a Pocket-Sized Ultrasound Device (PSUD). Assessment of vena cava inferior was less valid. PSUD readings, when added to the history and a physical examination, can improve nurse assessment of fluid status in patients with heart failure.
Dalen & Graven, Department of Medicine, Levanger Hospital, Nord-Trøndelag Health Trust, Norway	Feasibility and Reliability of Pocket-Size Ultrasound Examinations of the Pleural Cavities and Vena Cava Inferior Performed by Nurses in an Outpatient Heart Failure Clinic	European Journal of Cardiovascular Nursing, 2014	25122616	Specialized nurses were, after a dedicated training protocol, able to obtain reliable recordings of both pleural cavities and the inferior vena cava by PSID (pocket-size imaging device) and interpret the images in a reliable way. Implementing focused ultrasound examinations to assess volume status by nurses in an outpatient heart failure clinic may improve diagnostics, and thus improve therapy.

Vscan Family – Cardiology *(cont.)*

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Cardiology <i>(cont.)</i>				
Testuz & Burri, Cardiology Service, University Hospital, Geneva, Switzerland	Diagnostic Accuracy of Pocket-Size Hand-Held Echocardiographs Used by Cardiologists in the Acute Care Setting	European Heart Journal – Cardiovascular Imaging, 2013	22535657	The Vscan used by a trained cardiologist has good diagnostic accuracy in the emergency setting compared with a high-end echocardiograph, despite small screen size and lack of pulse-wave and continuous Doppler.
Kitada & Yoshikawa, Department of Internal Medicine and Cardiology, Osaka City University School of Medicine, Osaka, Japan Department of Cardiology, Nishinomiya Watanabe Cardiovascular Center, Nishinomiya, Japan	Diagnostic Accuracy and Cost-Effectiveness of a Pocket-Sized Transthoracic Echocardiographic Imaging Device	Clinical Cardiology, 2013	23893844	This study demonstrates that the pocket-sized portable Transthoracic Echocardiography (pTTE) provides accurate detection of cardiac structural and functional abnormalities beyond the ECG. In addition, the use of pTTE as an initial examination tool prior to standard TTE (sTTE) is cost-effective, suggesting that the pocket-sized pTTE is poised to alter the current diagnostic strategy in clinical practice.
Gianstefani & Monaghan, King's College Hospital, London, UK	Pocket-Size Imaging Device: Effectiveness for Ward-Based Transthoracic Studies	European Heart Journal – Cardiovascular Imaging, 2013	23708845	This study demonstrates that pocket-size imaging devices (PSID) can provide a valuable alternative to TTE in the presence of focused clinical questions and can provide an efficient way of delivering a ward-based transthoracic echo service.
Prinz & Faber, Department of Cardiology, Heart and Diabetes Centre North Rhine-Westphalia University Hospital of Bochum, Ruhr-University Bochum, Bad Oeynhausen, Germany	The Importance of Training in Echocardiography: A Validation Study Using Pocket Echocardiography	Journal of Cardiovascular Medicine, 2012	22929564	Well-grounded training in echocardiography leads to a rapid improvement in image acquisition and interpretation over a period of a few weeks. Basic diagnostic findings could be interpreted with high accuracy after short training. Interpretation of complex findings remained difficult. The time needed to carry out an examination using pocket echocardiography could not be reduced to less than 3 – 4 min. per patient. New educational concepts are warranted.
Prinz & Voigt, Department of Cardiology, University Hospital Gasthuisberg, Catholic University Leuven, Leuven, Belgium Department of Cardiology, Heart-Centre North Rhine-Westphalia, Ruhr-University Bochum, Bad Oeynhausen, Germany	Diagnostic Accuracy of a Hand-Held Ultrasound Scanner in Routine Patients Referred for Echocardiography	Journal of the American Society of Echocardiography, 2011	21126857	Hand-held echocardiography was feasible and missed no relevant findings. Given the future implementation of spectral Doppler capabilities, this hand-held scanner can safely be used in clinical routine.
Liebo & Topol, Scripps Clinic, Scripps Translational Science Institute, and West Wireless Health Institute, La Jolla, California, USA	Is Pocket Mobile Echocardiography the Next-Generation Stethoscope? A Cross-sectional Comparison of Rapidly Acquired Images with Standard Transthoracic Echocardiography	Annals of Internal Medicine, 2011	21727291	The rapid acquisition of images by skilled ultrasonographers who use Pocket Mobile Echocardiography (PME) yields accurate assessments of ejection fraction and some, but not all, cardiac structures in many patients. Further testing of the device in larger patient cohorts with diverse cardiac abnormalities and with untrained clinicians obtaining and interpreting images is required before wide dissemination of its use can be recommended.

Vscan Family – Cardiology *(cont.)*

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Cardiology <i>(cont.)</i>				
Choi & Lewis, The George Washington University, Washington, USA	Interpretation of Remotely Downloaded Pocket-Size Cardiac Ultrasound Images on a Web-Enabled Smartphone: Validation Against Workstation Evaluation	Journal of the American Society of Echocardiography, 2011	21925836	Remote expert echocardiographic interpretation can provide backup support to point-of-care diagnosis by non-experts when read on a dedicated smartphone-based application. Mobile-to-mobile consultation may improve access in previously inaccessible locations to accurate echocardiographic interpretation by experienced cardiologists.
Andersen & Dalen, Levanger Hospital, Nord-Trøndelag Health Trust, Levanger, Norway	Feasibility and Reliability of Point-of-Care Pocket-Sized Echocardiography	European Journal of Echocardiography, 2011	21810825	Point-of-care semi-quantitative evaluation of cardiac anatomy and function showed high feasibility and correlation with the reference method for most indices. Pocket-sized echocardiographic examinations of four min. length, performed at the bedside by experts, offers reliable assessment of cardiac structures, the pleural space and the large abdominal vessels.
Frederiksen & Sloth, Department of Anesthesiology and Intensive Care, Aarhus University Hospital, Skejby, Denmark	New Pocket Echocardiography Device is Interchangeable with High-End Portable System When Performed by Experienced Examiners	Acta Anaesthesiologica Scandinavica, 2010	21039344	The Vscan displays image quality interchangeable with larger and more expensive systems. The apparatus is well suited for performing a FATE examination in a 1-day surgery setting and could very well also be applicable in almost any situation involving patients with acute illness.
Cardim & Zamorano, Hospital da Luz, Cardiology Department, Lisbon, Portugal	Usefulness of a New Miniaturized Echocardiographic System in Outpatient Cardiology Consultations as an Extension of Physical Examination	Journal of the American Society of Echocardiography, 2010	21074362	The new MS (Miniaturized Echocardiographic System) caused a negligible increase in the duration of consultations. It showed additive clinical value over physical examination, increasing the number of diagnoses, reducing the use of unnecessary routine echocardiography, increasing the number of adequate echocardiographic studies, and determining a large number of releases from the outpatient clinic.

Vscan Family – Point of Care – Emergency Medicine

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Emergency Medicine				
* Pujol & Bobbia, Department of Anesthesiology, Emergency and Critical Care Medicine, Intensive Care Unit, Nîmes University Hospital, Nîmes / Emergency Department, Timone 2 Hospital, Aix-Marseille University, Marseille, France	Compression with a pocket-sized ultrasound device to diagnose proximal deep vein thrombosis	American Journal of Emergency Medicine, 2018	29653786	Compression ultrasonography performed with a pocket-sized ultrasound device by a trained emergency physician appears to be feasible in emergency practice for the diagnosis of proximal DVT. A study with a larger sample size will have to describe the accuracy.
Choi & Kwon, Department of Emergency Medicine, Seoul National University Bundang Hospital, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea	Effectiveness of education in POCUS-assisted physical examinations in an emergency department (ED) - A before-and-after study	Medicine, 2017	28640133	The education of point-of-care ultrasonography-assisted physical examination (POCUS-PE) in the emergency department (ED) successfully increased use of POCUS, and reduced the length of stay (LOS) and return visits (RV) rate in ED.
Colclough & Nihoyannopoulos, Imperial College Healthcare Trust, St. Mary's Hospital, Paddington, London, UK; Emergency Department, Kings College Hospital, London, UK	Pocket-Sized Point-of-Care Cardiac Ultrasound Devices – Role in the Emergency Department	Hertz, 2017	28341982	The Vscan is a practical, portable device that provides rapid diagnostic information. One third of patients had significant findings on the scans to possibly aid diagnosis and prevent misdiagnosis. This has the potential to reduce time to diagnosis in the ED.
Mancuso & Campos, Disciplina de Cardiologia – Escola Paulista de Medicina – Universidade Federal de São Paulo (Unifesp)1; Disciplina de Medicina de Urgência – Escola Paulista de Medicina – Universidade Federal de São Paulo (Unifesp)2, São Paulo, SP – Brazil	Focused Cardiac Ultrasound Using a Pocket-Size Device in the Emergency Room	Arq Bras Cardiol, 2014	25590933	The focused echocardiography with pocket-size equipment in the emergency care may allow a prompt diagnosis and, consequently, an earlier initiation of the therapy.
Schleder & Schreyer, Department of Radiology, University Medical Center Regensburg, Regensburg, Germany	Diagnostic Value of a Hand-Carried Ultrasound Device for Free Intra-Abdominal Fluid and Organ Lacerations in Major Trauma Patients	Emerg Med J, 2012	22518057	In major trauma patients, examination with Hand-Carried Ultrasound (HCU) according to the 'Focused Assessment with Sonography for Trauma' (FAST) principles for the diagnosis of organ lacerations and free intra-abdominal fluid is a reliable and rapid alternative to contrast-enhanced Multidetector CT (MDCT) scans and can help save precious time in emergency situations, and should, additionally, be evaluated in the pre-clinical workflow.

Vscan Family – Point of Care – Emergency Medicine *(cont.)*

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Emergency Medicine <i>(cont.)</i>				
Kajimoto & Abe, Division of Cardiology and Division of Internal, Medicine, Sensoji Hospital, Tokyo, Japan	Rapid Evaluation by Lung-Cardiac-Inferior Vena Cava (LCI) Integrated Ultrasound for Differentiating Heart Failure From Pulmonary Disease as the Cause of Acute Dyspnea in the Emergency Setting	Cardiovascular Ultrasound, 2012	23210515 OPEN ACCESS	Our study demonstrated that rapid evaluation by lung-cardiac-inferior vena cava (LCI) integrated ultrasound is extremely accurate for differentiating acute dyspnea due to acute heart failure syndromes (AHFS) from that caused by primary pulmonary disease in the emergency setting.
Biais & Janvier, Emergency Department, Hôpital Pellegrin, Centre Hospitalier Universitaire de Bordeaux, Bordeaux, France	Evaluation of a New Pocket Echoscopic Device for Focused Cardiac Ultrasonography in an Emergency Setting	Critical Care, 2012	22583539 OPEN ACCESS	In an emergency setting, this new ultraportable echoscope was reliable for the real-time detection of focused cardiac abnormalities.
Coskun & Şahin Kavakli, Ankara Training and Research Hospital; Ankara Atatürk Training and Research Hospital, Ankara, Turkey	Our New Stethoscope in the Emergency Department: Hand-Held Ultrasound	Turkish Journal of Trauma & Emergency Surgery, 2011	22289999	In conclusion, Vscan [...] seems to have a promising future as an indispensable gadget which, like the stethoscope, could be used by all medical practitioners and assist in the evaluation of trauma and other critical patients in the Emergency Department (ED).

Vscan Family – Point of Care – Prehospital

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Prehospital				
Rooney & Fox, Department of Emergency Medicine, Henry Ford Hospital, Detroit, Michigan, USA; Emergency Medicine, University of California, Irvine, Orange, California, USA	Pre-Hospital Assessment With Ultrasound in Emergencies: Implementation in the Field	World Journal of Emergency Medicine, 2018	27313806	Our pilot study suggests that with minimal training, paramedics can use point-of-care ultrasound (US) to obtain cardiac images that are adequate for interpretation and diagnose cardiac standstill. Further large-scale clinical trials are needed to determine if prehospital US can be used to guide care for patients with cardiac complaints.
Hu & Cao, Emergency Department, West China Hospital, Sichuan University Chengdu, PR China	Streamlined Focused Assessment with Sonography for Mass Casualty Pre-Hospital Triage of Blunt Torso Trauma Patients	American Journal of Emergency Medicine, 2014	24792938	Streamlined FAST may increase triage accuracy of blunt torso trauma patients in mass casualty incidents with limited medical resources. We recommend the use of SFAST to decrease patient triage to treatment time in any unfortunate future disasters.

Vscan Family – Point of Care – Critical Care

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Critical Care				
Breitkreutz & Seeger, Emergency Department – Hospital of the City of Frankfurt (Höchst) and Department of Cardiology – Johann Wolfgang Goethe University Hospital, Frankfurt am Main, Germany	Does the Integration of Personalized Ultrasound Change Patient Management in Critical Care Medicine? Observational Trials	Emergency Medicine International, 2013	24455272 OPEN ACCESS	We propose the development of novel ultrasound-based clinical pathways by integration of PersUS.
Schleder & Heiss, Department of Radiology, University Medical Center Regensburg, Regensburg, Germany	Bedside Diagnosis of Pleural Effusion with a Latest Generation Hand-Carried Ultrasound Device in Intensive Care Patients	Acta Radiologica, 2012	22661602	Due to its ease of use and its high diagnostic yield Hand-Carried Ultrasound (HCU) systems of the latest generation constitute a helpful technique for the primary assessment of Pleural Effusion (PE).
Amiel & Vignon, Medical-Surgical Intensive Care Unit, Dupuytren Teaching Hospital, Limoges, France	Assessment of Left Ventricular Ejection Fraction Using an Ultrasonic Stethoscope in Critically Ill Patients	Critical Care, 2012	22335818 OPEN ACCESS	In ICU patients, the extension of physical examination using an Ultrasonic Stethoscope (US) improves the ability of trained intensivists to determine LVEF at bedside. With trained operators, the semi-quantitative assessment of LVEF using the US is accurate when compared to standard TTE.

Vscan Family – Primary Care – Primary Care Physicians/ General Practitioners/Family Physicians

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Primary Care				
American Academy of Family Physicians (AAFP)	Recommended Curriculum Guidelines for Family Medicine Residents – Point of Care Ultrasound	AAFP Guidelines , 2018	N/A	This Curriculum Guideline is an evidence-based roadmap for family medicine residencies to equip their residents with the competencies, attitudes, knowledge, and skills necessary to effectively utilize POCUS in clinical practice.
Mihai Iacob	Evidence of the Point of Care Ultrasonography in Family Medicine	The World Book of Family Medicine, 2016	N/A	In conclusion, because of a significant number of advantages, ultrasonography should be a diagnosis tool beside the stethoscope in the general practitioner office. In our opinion, the two instruments should be considered as complementary. Medical research and interdisciplinary collaboration must continue and improve in order to increase the quality of care in Family Medicine and to achieve patient-centred care and thereby indirectly lower costs in the healthcare system.
Evangelista & Garcia-Dorado , Servei de Cardiologia, Hospital Universitari Vall d'Hebron, Barcelona, Spain	Hand-Held Cardiac Ultrasound Screening Performed By Family Doctors With Remote Expert Support Interpretation	Heart, 2016	26802099	Hand-Held Cardiac Ultrasound (HCU) performed at the point of care by Family Doctors (FD) with remote expert support interpretation using a web-based system is feasible, rapid and useful for detecting significant echocardiographic abnormalities and reducing the number of unnecessary echocardiographic studies.
Colli & Casazza , Internal Medicine Department, Ospedale A Manzoni, Lecco, Italy Department of Biomedical and Clinical Sciences “L. Sacco,” Università degli Studi di Milano, Milan, Italy	The Use of a Pocket-Sized Ultrasound Device Improves Physical Examination – Results of an In- and Outpatient Cohort Study	PloS ONE, 2015	25793296 OPEN ACCESS	After a simple and short training course, a pocket-sized ultrasound device (PUD) examination can be used in addition to a physical examination to improve the answer to ten common clinical questions concerning in- and outpatients, and can reduce the need for further testing.
Bornemann & Lustik , Department of Family and Preventative Medicine, University of South Carolina, Columbia Department of Family Medicine, Tripler Army Medical Center, Honolulu, USA	Assessment of Primary Care Physicians' Use of a Pocket Ultrasound Device to Measure Left Ventricular Mass in Patients with Hypertension	Journal of the American Board of Family Medicine (JABFM), 2015	26546645	This study showed that limited echocardiography for the detection of Left ventricular hypertrophy (LVH) performed by Primary Care Physicians (PCPs) at the point of care was feasible. Future studies are needed to determine the ideal training and experience necessary to yield competency.
Mjølstad & Haugen , Department of Cardiology, St. Olav's, Trondheim University Hospital, Trondheim, Norway	Assessment of Left Ventricular Function by GPS Using Pocket-Sized Ultrasound	Family Practice, 2012	22333323	With tailored training, GPs were able to assess LV function with septal mitral annular excursion (sMAE) and pocket-sized Ultrasound (pUS). pUS, as a supplement to the physical examination, may become an important tool in general practice.

Vscan Family – Primary Care – Internal Medicine

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Primary Care (cont.)				
Elhassan & Bahl, Department of Internal Medicine, UCSF, California, USA	Internal medicine residents' point-of-care ultrasound skills and need assessment and the role of medical school training	Advances in Medical Education and Practice, 2019	31213943	Our residents seem very interested in POCUS. PGY-1 residents with prior POCUS training in medical school seem to have higher confidence in their POCUS skills than PGY-1 residents without prior training and outperformed them in image interpretation test. The study is very instructive in building our future POCUS curriculum for residents.
Maw & Soni, University of Colorado, Denver, Colorado and University of Texas Health San Antonio and South Texas Veterans Health Care System, San Antonio, Texas, USA	Inpatient Notes - Why Should Hospitalists Use Point-of-Care Ultrasound?	Annals of Internal Medicine, 2018	29677272	In conclusion, we believe that use of ultrasound by hospitalists will continue to modernize the bedside evaluation and streamline the diagnostic process. We encourage residency training programs to teach POCUS, practicing hospitalists to incorporate it into daily practice, and hospitals and hospital medicine programs to provide easy access to the necessary technology.
Del Medico & Cogliati, Department of Internal Medicine, L.Sacco Hospital, Milan, Italy	Pocket-size ultrasound device in cholelithiasis: Diagnostic accuracy and efficacy of short-term training	Internal and Emergency Medicine, 2018	29982876	Pocket-size ultrasound (PSUD) is a reliable tool for the diagnosis of cholelithiasis when used by expert operators potentially reducing the need for further diagnostic tests. It can even be successfully used by non-expert operators in outpatients setting after a short focused training.
Galen & Southern, Department of Medicine, Division of Hospital Medicine, Albert Einstein College of Medicine and Montefiore Medical Center, Bronx, New York, USA	Ultrasound-Guided Peripheral Intravenous Catheters to Reduce Central Venous Catheter Use on the Inpatient Medical Ward	Quality Management in Healthcare, 2018	29280905	Ultrasound-guided peripheral IV might reduce unnecessary central venous catheters on general inpatient wards. A portable ultrasound used for this purpose was found to be acceptable by nursing staff.
Tsai & Kimura, Department of Graduate Medical Education, Scripps Mercy Hospital, San Diego, California, USA	Actual Use of Pocket-Sized Ultrasound Devices for Cardiovascular Examination by Trained Physicians During a Hospitalist Rotation	Journal of Community Hospital Internal Medicine Perspectives, 2016	27987287	When unbiased residents acting as hospitalists are provided with a pocket-sized device (PSD) to augment initial cardiac examination, usage is frequent and suggests clinical value in hospital medicine.
Saha & Spencer, Department of Medicine, Section of Cardiology, University of Chicago, Chicago, Illinois, USA	Outpatient Use of Focused Cardiac Ultrasound to Assess the Inferior Vena Cava in Patients With Heart Failure	The American Journal of Cardiology, 2015	26279108	Assessment of volume status in an outpatient cardiology clinic using focused cardiac ultrasound (FCU) imaging of the Inferior vena cava (IVC) is feasible in a high percentage of patients. A group of patients were identified with volume status discordant between FCU IVC and routine clinic assessment, suggesting that IVC parameters may provide a valuable supplement to the in-office physical examination.
Lopez-Palmero & Lopez-Martinez, Unidad de Gestión Clínica de Medicina Interna, Hospital Torrecárdenas, Almería, Spain	Diagnostic Utility of Handheld Ultrasonography as an Extension of the Physical Examination of Patients With Heart Failure	Revista Clinica Espanola, 2015	25746465	Handheld echocardiography performed by a medical internist, as an extension of the physical examination of patients with heart failure, is a valid and safe test that helps increase the diagnostic performance.

Vscan Family – Primary Care – Internal Medicine *(cont.)*

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Primary Care <i>(cont.)</i>				
Gulič & Dinevski, Department of Cardiosurgery, University Clinical Center Maribor, Slovenia	Pocket-Size Imaging Device as a Screening Tool for Aortic Stenosis	Wiener Klinische Wochenschrift, 2015	26659701	Pocket-size ultrasound imaging devices without continuous and pulse wave Doppler modalities can, even in the hands of a noncardiologist with limited cardiac ultrasound instructions with high sensitivity and specificity, be a useful tool for detecting more than mild aortic stenosis and more than mild mitral regurgitation. As such a focused cardiac ultrasound can be an extension of physical examinations for patients with newly discovered systolic murmur.
Colli & Casazza, Internal Medicine Department, Ospedale A Manzoni, Lecco, Italy Department of Biomedical and Clinical Sciences "L. Sacco," Università degli Studi di Milano, Milan, Italy	The Use of a Pocket-Sized Ultrasound Device Improves Physical Examination – Results of an In- and Outpatient Cohort Study	PloS ONE, 2015	25793296 OPEN ACCESS	After a simple and short training course, a pocket-sized ultrasound device (PUD) examination can be used in addition to a physical examination to improve the answer to ten common clinical questions concerning in- and outpatients, and can reduce the need for further testing.
Andersen & Dalen, Levanger Hospital, Nord-Trøndelag Health Trust, Levanger, Norway Medical Imaging Laboratory and Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trondheim, Norway	Diagnostic Influence of Routine Point-of-Care Pocket-size Ultrasound Examinations Performed by Medical Residents	J Ultrasound Med, 2015	25792578	By implementing pocket-size ultrasound examinations that took less than 11 minutes to the usual care, we corrected, verified, or added important diagnoses in more than one of three emergency medical admissions. Point-of-care examinations with a pocket-size imaging device increased medical residents' diagnostic accuracy and capability.
Filopei & Kory, Beth Israel – Mount Sinai, New York, NY, USA	Impact of Pocket Ultrasound Use by Internal Medicine House Staff in the Diagnosis of Dyspnea	Journal of Hospital Medicine, 2014	24891227	Lung ultrasound performed by residents with a pocket ultrasound improved the diagnostic accuracy of dyspnea. Two residents undergoing extended training showed a total increase in diagnostic accuracy.
* Arienti & Corazza, Department of Internal Medicine, Maggiore Hospital, Bologna, Italy First Department of Internal Medicine, Internal Medicine and Gastroenterology, St. Matteo Hospital, University of Pavia, Pavia, Italy	Bedside Ultrasonography (US), Echocopy and US Point of Care as a New Kind of Stethoscope for Internal Medicine Departments: The Training Program of the Italian Internal Medicine Society (SIMI)	Intern Emerg Med, 2014	25145290	Since 2005, the Italian Society of Internal Medicine (SIMI) and its Ultrasound Study Group has been holding a Summer School and training courses in ultrasound for residents in internal medicine. A national network of schools in bedside ultrasound was then organized for internal medicine specialists who want to learn this technique. Because bedside ultrasound is a user-dependent diagnostic method, it is important to define the limits and advantages of different new ultrasound devices, to classify them (i.e. Echocopy and Point of Care Ultrasound), to establish appropriate different levels of competence and to ensure their specific training. In this review, we describe the point of view of the Italian Internal Medicine Society on these topics.

Vscan Family – Primary Care – Internal Medicine *(cont.)*

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Primary Care <i>(cont.)</i>				
Panoulas & Nihoyannopoulos, Hammersmith Hospital, Imperial College Healthcare NHS Trust and Imperial College London, London, UK	Pocket-Size Hand-Held Cardiac Ultrasound as an Adjunct to Clinical Examination in the Hands of Medical Students and Junior Doctors	European Heart Journal of Cardiovascular Imaging, 2013	22833550	The use of Pocket-Size Hand-Held Echocardiographic (PHHE) after brief bedside training in the form of a tutorial greatly improved the clinical diagnosis of medical students and junior doctors, over and above history, physical examination, and ECG findings.
Razi & Spencer, University of Chicago, Chicago, Illinois – USA	Bedside Hand-Carried Ultrasound by Internal Medicine Residents Versus Traditional Clinical Assessment for the Identification of Systolic Dysfunction in Patients Admitted with Decompensated Heart Failure	Journal of the American Society of Echocardiography, 2011	21885245	Residents with limited training in cardiac ultrasound were able to identify left ventricular systolic dysfunction (LVSD) in patients with acute decompensated heart failure with superior accuracy compared with clinical, physical exam, lab, and electrocardiographic findings and an average of 22 hours before the results of formal echocardiography were available.

Vscan Family – Urology

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Urology				
Kameda & Taniguchi, Departments of Clinical Laboratory Medicine, Saiseikai Utsunomiya Hospital, Utsunomiya, and Jichi Medical University, Shimotsuke, Japan	Assessment of the renal collecting system using a pocket-sized ultrasound device	Journal of Medical Ultrasonics, 2018	29721640	Ultrasound using a pocket-sized ultrasound device is useful for evaluating dilatation of the collecting system, especially for ruling out its presence.
Lavi & Cohen, Department of Urology, Haamek Medical Center, Afula, Israel	A urologic stethoscope - Urologist performed sonography using a pocket-size ultrasound device in the point-of-care setting	International Urology and Nephrology, 2017	28643228	Urologist performed pocket ultrasound study is valid in evaluating the upper and lower urinary tract and is practical in many clinical scenarios. The urologic stethoscope is now becoming a reality within reach.
Daurat & Capdevila, Department of Anesthesia and Critical Care Medicine, Lapeyronie University Hospital, Montpellier, France	Diagnosis of Postoperative Urinary Retention Using a Simplified Ultrasound Bladder Measurement	Anesthesia & Analgesia, 2015	25642660	A simple ultrasound measurement of the largest transverse bladder diameter seemed to be helpful to exclude or confirm Postoperative Urinary Retention (POUR).

Vscan Family – Fetal/OB & GYN

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Fetal/Obstetrics & Gynecology				
Wastlund & Smith, Cambridge Institute of Public Health, Cambridge; Health Economics Group, Norwich Medical School, University of East Anglia, Norwich, UK	Screening for breech presentation using universal late-pregnancy ultrasound - A prospective cohort study and cost effectiveness analysis	PLOS Medicine, 2019	30990808	According to our estimates, universal late pregnancy ultrasound in nulliparous women (1) would virtually eliminate undiagnosed breech presentation, (2) would be expected to reduce foetal mortality in breech presentation, and (3) would be cost effective if foetal presentation could be assessed for less than £19.80 per woman.
Keable & Crozier, James Paget University Hospital; Norfolk; School of Health Sciences, University of East Anglia, Norwich, UK	Detection of breech presentation - Abdominal palpation and hand-held scanning by midwives	British Journal of Midwifery, 2018	N/A	The results support the use of hand-held ultrasound, as it did detect breech presentation before induction of labour or spontaneous labour and birth. Further work includes the audit of the reasons that hand-held ultrasound scanning was not used, to ensure that a targeted action plan can be created. Future research into midwifery values, cultural attitudes and the effectiveness of abdominal palpation is also needed, to develop the knowledge base on which scanning can be framed.
Galjaard & Devlieger, KU Leuven Department of Development and Regeneration: Pregnancy, Fetus and Neonate, Gynaecology and Obstetrics, University Hospitals Leuven, Leuven, Belgium	Use of a Pocket-Sized Ultrasound Machine (PUM) for Routine Examinations in the Third Trimester of Pregnancy	Ultrasound in Obstetrics & Gynecology, 2014	24357339	A battery-driven PUM (pocket-sized ultrasound machine) can be used in third-trimester obstetrics for routine assessment of fetal growth (biparietal diameter, transcerebellar diameter and femur length) and for assessment of fetal wellbeing.
Sayasneh & Bourne, Early Pregnancy and Gynaecological Scanning Unit, Queen Charlotte's and Chelsea Hospital, Imperial College, London, UK	Do Pocket-Sized Ultrasound Machines Have the Potential to be Used as a Tool to Triage Patients in Obstetrics and Gynecology?	Ultrasound in Obstetrics & Gynecology, 2012	22605511	The findings and final diagnosis in the three study groups were similar for both a pocket-sized ultrasound machine (PUM) used transabdominally and a high-specification ultrasound machine (HSUM) used transvaginally and/or transabdominally.

Vscan Family – Medical Education

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Medical Education				
Miller & Abuhamad, Eastern Virginia Medical School, Norfolk, Virginia, USA	Learner Improvement from a Simulation-Enhanced Ultrasonography Curriculum for First-Year Medical Students	Journal of Ultrasound in Medicine, 2017	28127792	Initial results show that we were able to successfully develop, implement, and evaluate performance of first-year medical students on their fundamental knowledge and performance of basic ultrasonography (US) using a model that emphasized hands-on simulation-enhanced training. Furthermore, most students found the experience to be a beneficial component of their education and indicated a desire for more US training in the medical curricula.
Nelson & Narula, Department of Emergency Medicine and Department of Medicine, Icahn School of Medicine at Mount Sinai, New York, New York, USA	Seeing is Believing – Evaluating a Point-of-Care Ultrasound Curriculum for 1st-Year Medical Students	Teaching and Learning in Medicine, 2016	27191830	Students and faculty valued the curriculum, and students demonstrated basic competency in performance and interpretation of ultrasound. Further study is needed to determine how to best incorporate this emerging technology into a robust learning experience for medical students.
Solomon & Saldana, Cardiovascular Division, Brigham and Women's Hospital and Harvard Medical School, Boston, MA, USA	Point-of-Care Ultrasound in Medical Education – Stop Listening and Look	The New England Journal of Medicine, 2014	24645940	A generation of physicians will need to be trained to view this technology as an extension of their senses, just as many generations have viewed the stethoscope. That development will require the medical education community to embrace and incorporate the technology throughout the curriculum.
Cawthorn & Johri, Queen's University, School of Medicine, Kingston, Ontario, Canada	Development and Evaluation of Methodologies for Teaching Focused Cardiac Ultrasound Skills to Medical Students	Journal of the American Society of Echocardiography, 2014	24433979	Third-year medical students were able to acquire Focused Cardiac Ultrasound (FCU) image acquisition and interpretation skills after a novel training program. Self-directed electronic modules are effective for teaching introductory FCU interpretation skills, while expert-guided training is important for developing scanning technique.
Andersen & Haugen, MI Lab and Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trondheim, Norway Clinic of Cardiology, St. Olav Trondheim University Hospital, Trondheim, Norway Levanger Hospital, Nord-Trøndelag Health Trust, Levanger, Norway	Feasibility and Accuracy of Point-of-Care Pocket-Size Ultrasonography Performed by Medical Students	BMC Medical Education, 2014	25070529 OPEN ACCESS	Medical students with minimal training were able to use a Pocket-Size Imaging Device (PSID) as a supplement to standard physical examination and successfully acquire acceptable relevant organ recordings for presentation and correctly interpret these with great accuracy.

Vscan Family – Emerging Care

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Emerging Care				
Mbuyita & Mbaruku, Ifakara Health Institute, Dar Es Salaam, Tanzania	Effects of Introducing Routinely US Scanning During Ante Natal Care (ANC) Clinics on Number of Visits of ANC and Facility Delivery: A Cohort Study	Archives of Public Health, 2015	26347809 OPEN ACCESS	We conclude that introduction of the simplified ultrasound scanning technology at lowest levels of care has an effect to improving ANC attendance in terms of number of visits and motivate facility delivery.
Mbuyita & Mbaruku, Ifakara Health Institute, Dar Es Salaam, Tanzania	Uptake of Training on Vscan by Midlevel Providers Working in Rural Health Facilities in Tanzania: Implications for Reliability	Biosafety & Health Education, 2014	N/A OPEN ACCESS	The study concludes that it is possible to train health providers to conduct routine scanning using Vscan at primary health facility level and produce quality scans and correct diagnosis similar to that of expert sonologist.

Vscan Family – Health Economics

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Health Economics				
Kitada & Yoshikawa, Department of Internal Medicine and Cardiology, Osaka City University School of Medicine, Osaka, Japan Department of Cardiology, Nishinomiya Watanabe Cardiovascular Center, Nishinomiya, Japan	Diagnostic Accuracy and Cost-Effectiveness of a Pocket-Sized Transthoracic Echocardiographic Imaging Device	Clinical Cardiology, 2013	23893844	This study demonstrates that the pocket-sized portable Transthoracic Echocardiography (pTTE) provides accurate detection of cardiac structural and functional abnormalities beyond the ECG. In addition, the use of pTTE as an initial examination tool prior to standard TTE (sTTE) is cost-effective, suggesting that the pocket-sized pTTE is poised to alter the current diagnostic strategy in clinical practice.
Gianstefani & Monaghan, King's College Hospital, London, UK	Pocket-Size Imaging Device: Effectiveness for Ward-Based Transthoracic Studies	European Heart Journal – Cardiovascular Imaging, 2013	23708845	This study demonstrates that Pocket-Size Imaging Devices (PSID) can provide a valuable alternative to TTE in the presence of focused clinical questions and can provide an efficient way of delivering a ward-based transthoracic echo service.
* Patel & Gunnarsson, Health Economics, GE Healthcare, Waukesha, WI, USA S2 Statistical Solutions, Cincinnati, OH, USA	Ultrasonography Guidance Reduces Complications and Costs Associated with Thoracentesis Procedures	Journal of Clinical Ultrasound, 2012	21994047	Ultrasonography-guided thoracentesis is associated with lower total hospital stay costs and lower incidence of pneumothorax and hemorrhage.

Vscan Family – Health Economics *(cont.)*

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Vscan Family – Health Economics <i>(cont.)</i>				
* Patel & Gunnarsson, Health Economics, GE Healthcare, Waukesha, WI, USA S2 Statistical Solutions, Cincinnati, OH, USA	Evaluation of Hospital Complications and Costs Associated with Using Ultrasound Guidance During Abdominal Paracentesis Procedures	Journal of Medical Economics, 2012	22011070	The use of ultrasound guidance in abdominal paracentesis procedures is associated with fewer adverse events and lower hospitalization costs than procedures where ultrasound is not used.
Cardim & Zamorano, Hospital da Luz, Cardiology Department – Lisbon, Portugal	Usefulness of a New Miniaturized Echocardiographic System in Outpatient Cardiology Consultations as an Extension of Physical Examination	Journal of the American Society of Echocardiography, 2010	21074362	The new MS (Miniaturized Echocardiographic System) caused a negligible increase in the duration of consultations. It showed additive clinical value over physical examination, increasing the number of diagnoses, reducing the use of unnecessary routine echocardiography, increasing the number of adequate echocardiographic studies, and determining a large number of releases from the outpatient clinic.

Other Articles Supporting Vscan Family

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Others				
Astudillo, Department of Internal Medicine, CHU Toulouse, France	Interest of echoscopy in global transverse clinical medicine	Rev Fr Med Hosp Polyval, 2019	N/A	Clinical echoscopy will be an integral part of the clinical examination at the patient's bedside for all physicians in the future. We have reviewed the very rich literature in recent years on the usefulness of echoscopy in cardiology, pneumology, gastroenterology and polyvalent hospital medicine. This general review shows that echoscopy improves the sensitivity of the physical examination, especially at the beginning of symptoms. This practice must be taught to physicians and to all future physicians engaged in global clinical medicine.
Narula & Braunwald, Icahn School of Medicine at Mount Sinai, New York, New York, USA; Brigham and Women's Hospital and Harvard Medical School, Boston, Massachusetts, USA	Time to Add a Fifth Pillar to Bedside Physical Examination – Inspection, Palpation, Percussion, Auscultation, and Insonation	JAMA Cardiology, 2018	29490335	The imaging-assisted physical examination must be considered as a part of the bedside examination for situations in which it can add value. It is emphasized that bedside imaging is neither meant to replace physical examination nor full-scale imaging if needed subsequently. It is time to add a fifth pillar to the armamentarium of modern physical examination, insonation, with a miniaturized, portable handheld device.
Koizi & Young, GE Healthcare University Hospitals Coventry and Warwickshire NHS Trust, UK	Improving the Outcomes of Deep Vein Thrombosis – Optimising the Diagnostic Pathway	Thrombus, 2016	N/A	Given their crucial role throughout the deep vein thrombosis (DVT) pathway, nurses represent a key source of potential operational improvement. The immediate availability of portable ultrasonography devices (PUSD) raises the possibility of potentially conducting ultrasound scans for every patient suspected of DVT, without needing to wait for blood tests results. Implementing nurse-led ultrasound diagnosis of DVT has potential clinical, economic and resource use benefits. Reducing the time to diagnose DVT could potentially avoid the use of self-injected low molecular weight heparin by patients.
Dietrich & Braden, Medizinische Klinik 2, Caritas-Krankenhaus Bad Mergentheim, Akademisches Lehrkrankenhaus der Universität Würzburg, Germany	Echoscopy	Praxis, 2015	26373907	The clinical use of pocket size ultrasound devices is still at an early stage. Its performance has been studied and proven in cardiology, gynecology, and gastroenterology. It is expected that the image quality will improve and that more techniques for miniaturized devices will be available in the near future. The perspective will be that more and more clinicians will have "echoscopy" as a bedside tool, replacing or complementary to a "stethoscope." The term "echoscopy" was defined by the European Federation of Societies of Ultrasound in Medicine and Biology (EFSUMB). Echoscopy is one form of point of care ultrasound (POCUS). Teaching material has been prepared by EFSUMB on how to use it (www.efsumb.org).

Other Articles Supporting Vscan Family *(cont.)*

First Author & Last Author, Institution	Title	Journal, Date	PubMed ID (PMID)	Conclusion from Abstract
Others <i>(cont.)</i>				
Badano & Fioretti, Department of Cardiopulmonary Sciences, Azienda Ospedaliero-Universitaria S Maria della Misericordia, Udine, Italy	Improved Workflow, Sonographer Productivity, And Cost-Effectiveness of Echocardiographic Service for Inpatients by Using Miniaturized Systems	European Journal of Echocardiography, 2009	19252189	Implementation of digital echocardiography, certified sonographers, and a miniaturized echo system allowed improvement of the cost-effectiveness of the service provided by the echo-lab for inpatients, and avoided patients' discomfort derived from prolonged waiting time before and after the exam.
Sztajzel & Sarasin, University Hospital Geneva, Switzerland	Accuracy of Cardiac Auscultation in the Era of Doppler Echocardiography. A Comparison Between Cardiologists and Internists	International Journal of Cardiology, 2008	18762344	Our findings show that in the Doppler-echocardiographic era overall cardiac auscultatory proficiency for common valvular lesions is similar in cardiologists and internists. Cardiologists perform better than internists only when auscultating more rare cardiac lesions, such as cases of Atrial Septal Defect (ASD) or Hypertrophic Cardiomyopathy (HCM).
Trambaiolo & Salustri, Department of Cardiology, Policlinico Luigi Di Liegro, Rome, Italy	A Hand-Carried Cardiac Ultrasound Device in the Outpatient Cardiology Clinic Reduces the Need for Standard Echocardiography	Heart, 2007	16940393	The use of a simple HCU device in the outpatient cardiology clinic allowed reliable diagnosis in one third of the patients referred for echocardiography, which translates into cost and time saving benefits.

Imagination at work

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